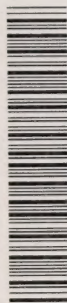


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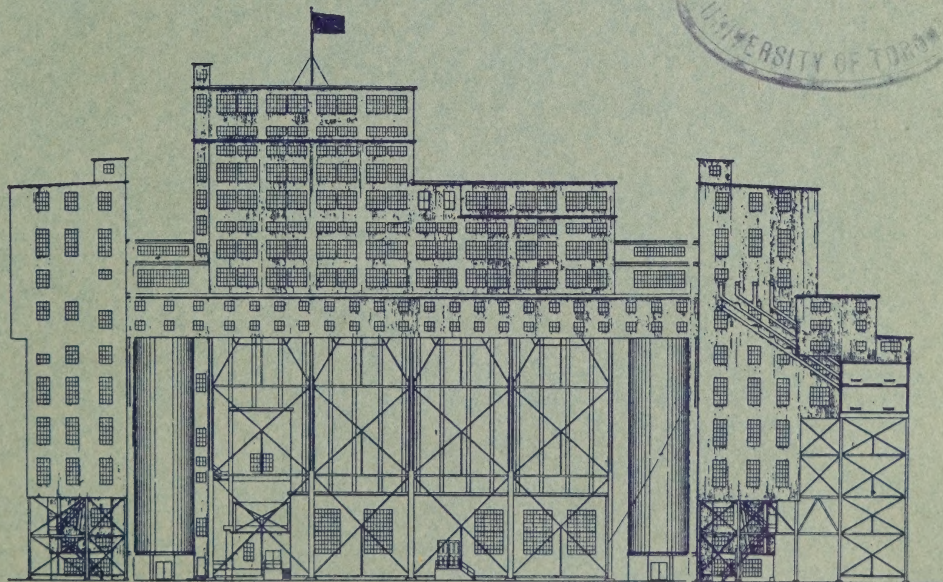


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Canada. Montreal Harbour Commission

The
HARBOUR
of
MONTREAL

Government
Publication



ANNUAL REPORT 1923

OFFICIALS

M. P. FENNELL, JR., GENERAL MANAGER AND SECRETARY
THOS. F. TRIHEY, ASSISTANT TO THE SECRETARY
PAUL LAROCQUE, TREASURER
GEORGE E. SMART, COMPTROLLER
THOS. W. HARVIE, CHIEF ENGINEER
F. W. COWIE, CONSULTING ENGINEER
PAUL LECLAIRE, ASSISTANT CHIEF ENGINEER
G. R. DALKIN, MECHANICAL ENGINEER
T. E. SALTER, ELECTRICAL ENGINEER
CAPT. J. F. SYMONS, HARBOUR MASTER
CAPT. D. J. PERRAULT, DEPUTY HARBOUR MASTER
ROBT. A. EAKIN, PAYMASTER AND WHARFINGER
J. VAUGHAN, SUPT. OF RAILWAY TERMINALS
R. L. MERCIER, ASST. SUPT. OF RAILWAY TERMINALS
M. PETERSON, GENL. SUPT. OF GRAIN ELEVATORS
GEO. GENDRON, MECHANICAL SUPERINTENDENT
I. C. FRANKLIN, MANAGER OF COLD STORAGE WAREHOUSE
L. H. A. ARCHAMBAULT, PURCHASING AGENT
P. E. MORANT, SUPERVISOR OF CUSTOMS WHARFAGES
LIEUT.-COL. E. A. WILLIAMS, CHIEF OF POLICE

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ANNUAL REPORT
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Harbour Commissioners
of Montreal
For the Year 1923

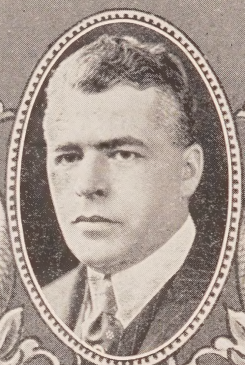


COMMISSIONERS:

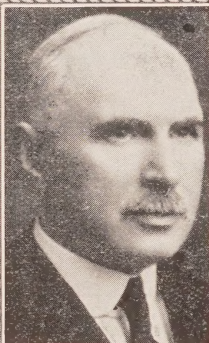
W. L. McDOUGALD, President

EMILIEN DAOUST

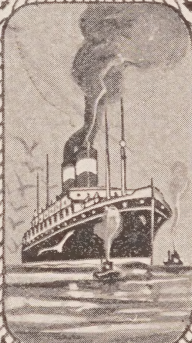
MILTON L. HERSEY



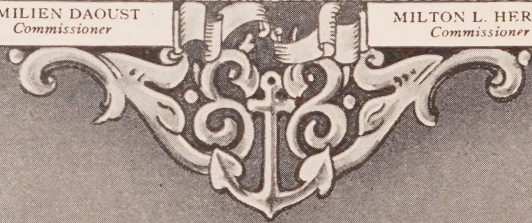
W. L. McDOUGALD
President



EMILIEN DAOUST
Commissioner



MILTON L. HERSEY
Commissioner



Harbour Commissioners of Montreal

MONTREAL, 1st April, 1924.

To the Hon. P. J. ARTHUR CARDIN, K.C., M.P.,
Minister of Marine and Fisheries,
Ottawa, Ont.

Sir:—

In compliance with Section 51 of the Commissioners' Act 57-8 Victoria, Chapter 48, the Harbour Commissioners of Montreal herewith respectfully submit their Annual Report of operations for the year ended 31st December, 1923.

We have the honor to be,
Sir,

Yours very respectfully,

W. L. MCDOUGALD, President.
EMILIEN DAOUST,
MILTON L. HERSEY,
Commissioners.

IN PRESENTING their Annual Report for the year Nineteen hundred and twenty-three, the Harbour Commissioners of Montreal wish to express their recognition of the unfailing support and courteous co-operation of the Minister of Marine and Fisheries, the Hon. Ernest Lapointe, and his Deputy Minister, Mr. Alexander Johnston, and the other officers of the Department at Ottawa, whose kindly interest has been of very material assistance to them in the solving of the many problems which they were called upon to deal with during the year.

Harbour Commissioners of Montreal

ANNUAL REPORT

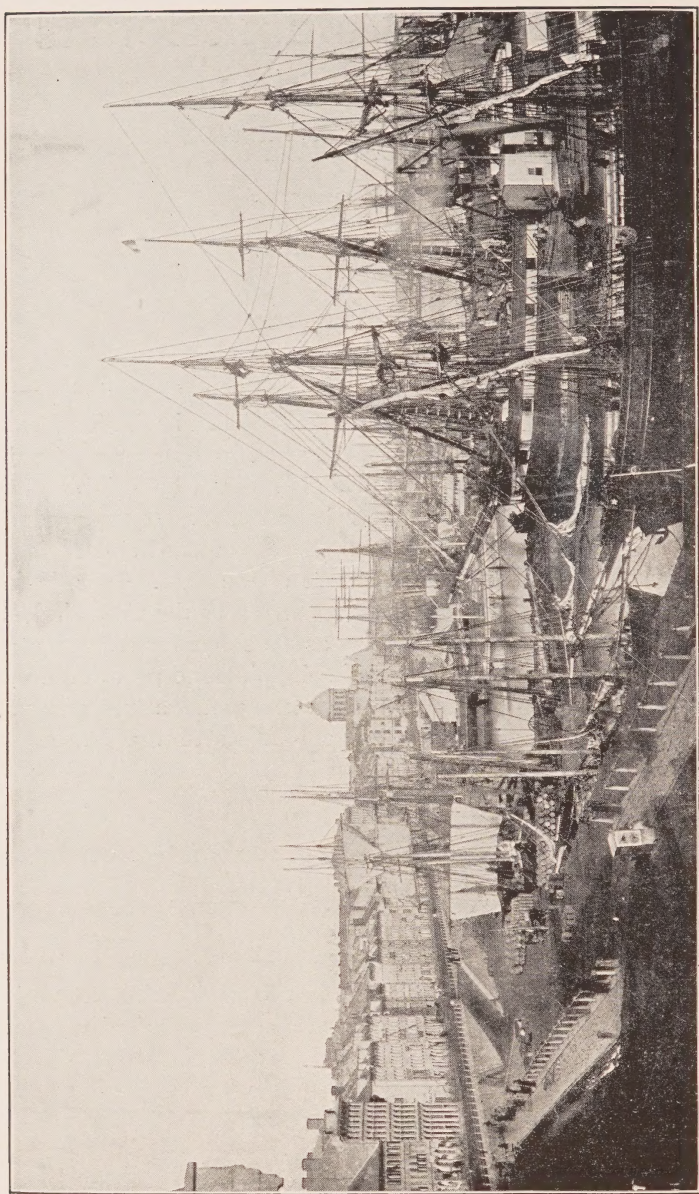
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FOREWORD

The Annual Report of the Harbour Commissioners of Montreal, required by law to be prepared and submitted to the Minister of Marine and Fisheries and by him transmitted to Parliament, was designed primarily to be an exhibit of the financial operations of the Harbour Board. It has gradually grown into a somewhat comprehensive record and review of the shipping trade and commerce of the Port. It is, in fact, the Harbour's Log Book. In recent issues the Commissioners have sought to employ it also as a vehicle for recording and conveying to those concerned in shipping and port affairs such observations as they wish to make upon matters of general interest, having also a specific relation to the Harbour of Montreal.

Re-organization of Staff: Creation of Department of Trade and Transportation

In the closing months of the year now under review the Commissioners had under earnest consideration a project which, however, was brought to consummation not until early in 1924, and which they consider may be regarded as the outstanding administrative accomplishment of the year. The reorganization of the staff and the creation of the new department of Trade and Transportation, effective as of March 10, 1924, constitute a departure in Harbour management of far-reaching import. It is, therefore, appropriate that the details



MONTREAL HARBOUR, 1872. OPPOSITE PLACE ROYALE

of the reorganization and the considerations which actuated the Commissioners should be set forth and recorded in this Report. These were fittingly and succinctly stated in the city press as follows:—

An important reconstruction of the Staff of the Harbour Board was effected at a meeting of the Commissioners held Saturday afternoon, at the conclusion of which Dr. W. L. McDougald, the President, announced the retirement of M. P. Fennell, Jr., as General Manager and Secretary, and the following appointments, effective at once:—

General Manager, Thomas W. Harvie,
Secretary, Thomas F. Trihey,
Chief Engineer, Paul Leclaire.

Mr. Fennell has been offered and has accepted a post now created by the Commissioners, that of Director of Trade and Transportation, the duties of which he enters upon forthwith. The office of General Manager and Secretary, heretofore held by Mr. Fennell, has been divided. Mr. Harvie, heretofore Chief Engineer, becomes General Manager, having jurisdictional charge over all the services and physical activities of the Harbour. Mr. Trihey, heretofore Assistant Secretary, becomes Secretary, with jurisdictional charge over the clerical staff, records and archives. Mr. Leclaire, heretofore Assistant Chief Engineer, becomes Chief Engineer.

In giving out this announcement, Dr. McDougald said:—A cardinal and also a gratifying feature of these changes is that it has been possible to give effect to them without going outside the personnel of the existing staff. These officers, who have been promoted, have risen to their present positions progressively through long years of diligent and arduous and loyal service at the Harbour. It is a highly specialized service, requiring not only long training, but peculiar aptitude in the individual. The Commissioners have had some such re-organization as is now carried out in contemplation for a considerable period, and they have given earnest consideration to the principle which should guide them in selecting the new officers. They have been from the beginning anxious to adopt the principle of promotion. It has been a source of much gratification to them that the character and training and suitability of members of the existing staff was so manifest as to enable them to adhere to that sound principle; as well as to relieve them and the Harbour and the Shipping Interests of the Port of the risk and experiment which would be entailed in bringing in untrained and untried hands.

As Mr. Harvie is himself an Engineer with such first-hand familiarity with every detail of the physical development of the Harbour and all its works as could not be acquired by a stranger in years of service, the post of Assistant Chief Engineer will not be filled. Mr. Harvie's technical skill and knowledge will remain available and will automatically merge into the discharge of his functions as General Manager. Mr. Leclaire's professional competency is, I believe, quite generally recognized by his confreres of the engineering profession, and he has had to his credit many years of service on the Engineering Staff. Mr. Trihey has likewise had a similar advantage in his department. The Commissioners are confident that the new scheme of management which they are adopting will tend to still greater efficiency in all departments.

The Commissioners entertain high expectations with regard to the advantage which they expect will accrue to the Port and to the St. Lawrence route from the activities of the Director of Trade and Transportation abroad. Our own continent provides tonnage outbound over this route in

yearly expanding volume. That is not enough:—to secure the highest efficiency, to reduce such disparity in tonnage rates as exists at times in favour of other Ports, to attract bottoms other than those of the regular liners and counteract and ultimately remove the discrimination in marine insurance rates, we need to stimulate the movement of general cargo. There are incalculable possibilities in the diversion over the St. Lawrence route of a substantial share of the cargo, running into millions of tons, originating on the continent of Europe and destined to the interior of the continent of America. Our facilities and advantages over all other Ports on the Atlantic for handling this inbound cargo with cheapness and celerity are not so well known to shippers in Europe as they are to shippers on this continent. Commissioner Daoust and myself, during visits which we lately made to Europe, found opportunities for investigating these possibilities at first hand, and in some detail. We became convinced that not only could much good be got from the institution of an intensive publicity campaign abroad, but that it was a duty which the Harbour owes to the commerce of Canada to take up such a service and to carry it out upon broad lines. There is abroad an infinite variety of import and export agents and bureaux, Chambers of Commerce and Shipping, Boards of Trade, Marine Associations and the like which, or whose members, originate and direct the movement of cargo across the Atlantic. It was surprising to find how meagre was the knowledge amongst them of the advantages which the St. Lawrence route offers to shippers even to Canada; much less were they aware of the premier facilities provided by Canada in her great ocean terminal here and in her highly developed system of river, lake and rail transport for reaching all of the Great Lakes and middle West regions.

To acquaint these agencies and others in a position to control the routing and movement of cargo from Europe with these facilities is possible only by aggressive individual representation; and so the idea was evolved of sending a special emissary to open up and develop this branch of the service. I may here say that our colleague, Dr. Milton Hersey, gave constant and helpful consideration to these developments as they progressed, and the Commissioners are therefore unanimous in agreeing to the advisability of the arrangements now effected.

Obviously such a service could be entrusted to and should be undertaken only by one equipped with the most intimate first-hand knowledge of every phase of the situation both here and abroad; one, moreover, whose contacts and achievements would ensure him access to shipping circles, to port authorities and to commercial bodies wherever he would go. These specifications point definitely to our late General Manager. Mr. Fennell goes abroad somewhat in the quality of a pioneer, for such a service to the commerce of Canada has never been undertaken before. For a time he will plow a lonely furrow, no doubt, but his energetic initiative and all-inclusive knowledge of his duties, the Commissioners are certain, will get results, and that soon.

The Commissioners in reaching this determination had the advantage of careful and first-hand observation and inquiry, as noted in the official statement, extending over important areas of Western Europe. It was curious to note how inadequate is the conception of Canada, of Atlantic and American trade routes and markets, held even by the average European of affairs. The returning Commissioners were impressed with the

possibilities which might be made to accrue from an aggressive and systematic presentation of the claims of the St. Lawrence route for a more generous share than it now enjoys of the vast tonnages moving from these areas to the Atlantic Coast and destined for the interior of this continent. In few instances, indeed, was it found that shippers or even transport experts abroad had any appreciation of the strategic position of the Port of Montreal as a point of distribution to almost half the population of North America; or that water-borne cargoes from overseas could be conveyed without breaking bulk 1,000 miles inland from the Atlantic Ocean to the Port of Montreal and then transhipped by rail and water into every part of the continent. Nor did it appear to be generally known, even in Great Britain, that the Port is the natural export market for the largest grain surpluses produced by any country in the world. In Europe "Manitoba" wheat is a trade term seldom identified with a particular geographical area or even with Canada. From force of habit and long-established usage buyers of this commodity almost always turn instinctively to a United States grain market.



MONTREAL HARBOUR, 1762.

From original engraving by Thomas Jeffreys, from drawing by Thomas Patten

They are stimulated to this also by the Shipping Agents (other than the few having direct Montreal affiliations) who either control or are able to direct the routing of outgoing cargoes and from habit or lack of knowledge prefer an Atlantic Coast port. Manifestly the urgent need is publicity and persistent publicity; the constant and impressive dissemination of the essential facts relating to the St. Lawrence route, the facilities and advantages which it affords to shippers in-bound no less than out-bound, and, above all, the superior character of the plant and equipment of the Port for storing and for the expeditious loading and unloading of every description of cargo at minimum cost.

The Commissioners have accordingly despatched the Director of Trade and Transportation abroad to inaugurate an aggressive campaign. The field of activity is of such extent, since it embraces a population double that of all of North America as to afford him ample scope for the exercise of all the talents with which he is so notably endowed.

Corollary to the creation of the new department of Trade and Transportation would be the development of general warehousing facilities within the Harbour. Possibly the time is not yet ripe for introducing this system into the fabric of the Harbour with all the detail of plant and appurtenances which have been found so successful in actual operation in certain European ports. The Commissioners are, however, persuaded that an opportunity is now at hand for subjecting the idea to actual test locally without engaging them at the same time in a programme from which in another season it might be found advisable to recede. Experience with the actual operation of the cold storage warehouse very early demonstrated the utility of that service to the trades for which it was designed, and its great value to producers as far distant as Saskatchewan. It is conceivable that the service may have to be greatly enlarged at no distant date.

It appears to the Commissioners now to be imperative that they should at once provide at least the nucleus of a modern warehousing system for goods and merchandise, to facilitate the unloading, breaking bulk and storing of the same, and re-

packing into small units for transshipping and forwarding as and when required. Existing warehousing facilities, other than those of the cold storage warehouse, are those which are assigned specifically to the uses of the shipping companies upon the docks. There is an active demand constantly being pressed upon the Commissioners for similar space to be made available for consignments in general and to await shipping directions.

The peculiar adaptability of the Port of Montreal for this purpose was elaborated in the last Annual Report and in the several addresses upon the subject delivered by the President of the Board, as well as in numerous articles in the newspaper press. So far as the Commissioners are aware, no substantial answer has been made to the case thus made up by those opposed to the project. An influential authority has insisted that the existing drawback privileges and warehousing system created under the Canada Customs' Act meet all requirements. This argument might be found tenable if warehouses of modern type and equipment were in existence and so situated with relation to other harbour utilities as to be able to be efficiently and economically operated. With few exceptions existing bonded warehouses are of obsolete type, are not of fire-proof construction, are not equipped for economical and speedy operation and are mostly situated at points remote from the harbour utilities. In most instances also they are utilized and operated by private importing firms and are not available nor capable of being made available for the character of service contemplated in a modern free zone scheme. The Commissioners are persuaded that the needs of the situation demand the inauguration of this system in the Harbour of Montreal.

CHICAGO SANITARY DISTRICT DIVERSION

A question of capital importance to the Port and Harbour of Montreal which has commanded wide discussion here and in the United States the Commissioners feel should have some attention in this Report—the diversion of water from Lake

Michigan and the Great Lakes system by the Chicago Sanitary District.

This is of urgent local interest because of measures which the Sanitary District has submitted to the Congress of the United States in its current session for giving sanction to its proceedings during several years past in diverting 10,000 cubic feet of water per second from Lake Michigan and for authority to continue such diversion in perpetuity. The present withdrawal is the equivalent of a stream 100 feet wide, 10 feet in depth and having a flow of three miles per hour.



MONTREAL HARBOUR, 1830

The rights, if any, of the Sanitary District in the premises have been challenged in the courts by the Federal authorities, by certain Municipalities and States in the United States of America and by corporations and individuals concerned in the maintenance of the water levels of the Great Lakes and the St. Lawrence. Certain of these proceedings now await argument and adjudication in the Supreme Court of the United States, and the issue will determine, it is said, the rights of the Sanitary District as between it and the Federal Government.

The works which have been created by the Sanitary District during a gradual development extending over the past thirty years are of such magnitude as to warrant being ranked by its creators (see their "Memorandum" for Congress dated December, 1923) when completed "as one of the wonders of the world." The same authority fixes the cost of construction up to January 1, 1923, of the "Dilution and Navigation Project and Water Power Development" at \$98,989,372.73 and of the "Sewage Treatment" project at \$25,478,651.58, a total of \$123,072,321.56; while, besides, a further construction program has been laid down for the years 1923 to 1945 providing for the expenditure of \$106,322,000 chiefly upon sewage treatment projects. For the effective operation of these works as at 1923 no less than 10,000 c.f.s. of water must be diverted, and this quantity will rise variably with the normal growth of population in the period 1923-45 to a temporary maximum of 16,400 c.f.s., receding, with the completion of these treatment projects, to a minimum permanent withdrawal from 1945 forward of 10,000 c.f.s. for dilution and navigation.

In the language of a former Secretary of War, the Hon. Henry L. Stimson, the question has taken on not merely a national but an international character. Since not merely the efficiency but the very existence of every harbour upon the Great Lakes and the St. Lawrence River is threatened by the present operations no less than by the insidious designs of the Sanitary District for the future, it seems to the Commissioners to be of value and interest briefly to set forth the genesis and growth of the Chicago development as an aid to a clear apprehension of the happenings reported from time to time in the press.

The City of Chicago is situate upon the West Shore of Lake Michigan some miles above the lower bend of the lake. The Chicago River, a small stream originally flowing east by south, emptied into the lake at this place. About a half mile from its mouth the river forks into two streams locally known as the North Branch and the South Branch. The South Branch, as a component part of the main stream, is

navigable for certain types of lake craft, for some miles through the present city, constituting practically the only commercial dockage available for its shipping. The lake front affords no safe anchorage and is not in use for commercial purposes, the formation of the terrain being flat and sandy, the shore unsheltered and often tempestuous and treacherous.

The Lake Michigan watershed reaches its apex at a distance inland irregularly from the lake of no more than about 16 to 20 miles. This territory was originally drained principally by the South Branch of the Chicago River and by a small and sluggish stream, the Calumet, which enters the lake at South Chicago several miles below the city centre. The original settlement was made upon the north side of the river—where in frontier days was located a military post, Fort Dearborn—upon lands pre-empted about 1830 by a Canadian, one Alexander Beaubien. The city site and adjacent lands extending around the south of the lake were low-lying and swampy.

The Mississippi Valley watershed extends to the west from the summit of the slight elevation behind the city, and embraces all of the rest of the northern part of the State of Illinois. It is drained in this region by the Illinois and Desplaines Rivers, the former a stream of considerable magnitude. In the middle of the last century a barge canal, the Illinois and Michigan, was constructed for the purpose of linking up the waters of the Chicago and Illinois Rivers. The South Branch was canalized and locks were built at Joliet, close to the summit height, where the channel discharges into the Desplaines River, thence, as designed, into the Illinois River and on to the Mississippi. There is a fall here of about 40 feet from the level of the channel to the river, thus affording, in the new drainage channel project, a water-power site and augmenting the value of other sites along the rivers' courses; all of which has since acquired controlling importance in the dealings with this project.

After the opening of the railway era the canal lost its importance as a traffic route. With the growth of the city the canal and river became an open sewage ditch whose copious

and steadily increasing discharges into the lake became a menace to the city's only domestic water supply. In partial alleviation of this menace a pumping system was established in the South Branch by means of which a portion of the accumulations was lifted into the canal and discharged into the Desplaines River.

In this extremity the plan was evolved of deepening the river, constructing a new canal channel parallelling the old one in part, lowering the canal locks, and thus reversing the flow of the river out of instead of into the lake. Lake contamination was thus to be ended and the domestic water supply was to be restored to its pristine purity. Having behind it the vast reservoir of the Great Lakes, there was a never-to-be-exhausted supply of water for diluting the sewage and manufacturing wastes of an immense city to a consistency which would enable fish-life to exist in the drainage channel and rivers.

Under legislation of the General Assembly of the State of Illinois the Chicago Sanitary District was created, and by it this project, commenced in 1892, was consummated about the year 1900. The population of the city when the plan was undertaken had not yet reached 1,000,000 inhabitants; upon its completion this figure had risen to about 1,650,000, while to-day it exceeds 3,000,000, and there is a natural annual increase of about 75,000. At its inception it was entirely a sanitary measure, and it is probable there was no thought of water power or of diverting lake water for any other purpose than for sewage dilution.

Up to this stage the sole sanction of the Sanitary District for this ambitious enterprise was the legislation of the General Assembly or Legislature of the State of Illinois. It created and delimited the boundaries of the District, and constituted the corporation with powers to levy taxation and emit securities for money borrowed; and to construct, erect and carry out all works requisite for reversing the courses of the Chicago and Calumet Rivers so as to enable a quantity of water to be diverted from Lake Michigan equal to 20,000 cubic feet per minute for each 100,000 of population. But Lake Michigan, the only one of the Great Lakes lying wholly within the terri-

tory of the United States, is a navigable body of water flowing directly into Lake Huron through the Straits of Macinac, and thus is connected with and is an integral part of the system of Great Lakes and international navigation. It is thus subject to the jurisdiction of the Government of the United States and not to that of any one of the four States—Wisconsin, Illinois, Indiana and Michigan—which abut its shores. This jurisdiction for administrative purposes is exercised by the Secretary of War, under whom the bureau of the U.S. Corps of Engineers controls all harbours and navigable waters of the United States. It, therefore, became necessary for the Sanitary District to procure a permit authorizing the withdrawal of waters. The first application was made to Secretary of War R. A. Alger, who, on May 8, 1899, permitted a flowage not exceeding in volume 300,000 cubic feet per minute (5,000 cubic feet per second).

Upon subsequent applications from the Sanitary District permits were issued as follows:—

(B) April 9, 1901, a flow of 200,000 c.f.m. (3,333 c.f.s.) from midnight to 4 p.m., followed by 300,000 c.f.m. (5,000 c.f.s.) from 4 p.m. until midnight.

(Note:—Equal to an average of 3,884 c.f.s. for 24 hours.)

(C) December 5, 1901, a flow of 250,000 c.f.m. (4,167 c.f.s.) throughout 24 hours of day.

(D) January 17, 1903, a flow of 350,000 c.f.m. (5,833 c.f.s.) during winter (closed navigation season) of that year until March 31, 1903.

(E) After expiration of time limit of permit "D" the limit of permit "C" of December 5, 1901, came again into effect.

Renewed applications were made from year to year for authorization to increase the flow, but these have been declined by successive Secretaries of War, so that the limit of 4,167 c.f.s. has continued until this date. The language of the Hon. Henry L. Stimson, Secretary of War, in a ruling made by him January 8, 1913, on an application to permit an increase to 10,000 c.f.s., is informative and significant:

"Permission to divert water from Lake Michigan was first granted by my predecessor, Secretary Alger, on May 8,

1899. He permitted a flowage of 5,000 c.f.s. Subsequently, during the administration of Secretary Root, the amount of the current permitted to be taken was modified or restricted until December 5, 1901, when it was fixed at the amount now permitted. . . .

"On March 14, 1907, an application made for permission to divert an additional 4,000 c.f.s. . . . was denied by Secretary Taft in an opinion in which he referred once more to the desirability of submitting this question of capital and national importance to the Congress of the United States. . . . The Sanitary Canal has never received the sanction of Congress. It was built solely under the authority of the State of Illinois. . . . And although, pursuant to the suggestion of my predecessors, the question of the propriety of its diversion of water from Lake Michigan was presented urgently in the reports of the chief of engineers for the years 1899 and 1900 as transmitted to Congress, no action upon the question has ever been taken by that body."

All of these proceedings have been carried out without notice to any Canadian or British authority (excepting as hereinafter mentioned), and without request for the acquiescence or leave of any of the interests whose navigation and maritime rights were certain to be profoundly affected. The Canadian Government has never at any time assented to any of the steps taken; on the contrary, when aware of applications pending before the Secretary, formal protests have been lodged. There are no treaty provisions governing or relating to this question, though the contention has lately been advanced upon the part of the Sanitary District that the Boundary Waters Treaty of 1909 at least tacitly sanctions the diversion, inasmuch as the use of the waters of the Great Lakes is fixed in that document, "for public health and sanitation first, navigation second, and water-power third." Mr. Secretary Stimson, in the ruling hereinabove mentioned, considered this contention and disposed of it as follows:—

"A careful consideration of that treaty fails to indicate to me that it is in any way controlling upon the questions now before me. It gives to the citizens of both countries certain mutual rights of navigation in the waters of the Great Lakes and their connecting rivers; but beyond that the question of the right to this diversion at Chicago seems to me to have been

carefully excluded. The applicants for the permit have urged upon me that Article 8 of the treaty gives a preference to the uses of the water of the lakes for domestic and sanitary purposes over the uses of such water for navigation. Article 8, however, applies only to future cases brought before the International Joint Commission; and furthermore, I am clearly of the opinion that the domestic and sanitary purposes referred to in that article were intended to be the 'ordinary' uses of such waters for domestic and sanitary purposes referred to in Article 3. It would be quite contrary to our own national policy to give such a preference to an extraordinary anitary use of such a character as to create a substantial njury to navigation."

Having regard to the considerations so lucidly stated in the foregoing extracts, the Secretary announced his denial of the application in the following terms:—

"First. That the diversion of 10,000 c.f.s. from Lake Michigan, as applied for in this petition, would substantially interfere with the navigable capacity of the navigable waters in the Great Lakes and their connecting rivers;

"Second. That that being so, it would not be appropriate for me, without express congressional sanction, to permit such a diversion, however clearly demanded by the local interests of the sanitation of Chicago;

"Third. That on the facts here presented no such case of local permanent necessity is made evident;

"Fourth. That the provisions of the Canadian treaty for a settlement by joint commission of 'questions or matter of difference' between the United States and Canada offer a further reason why no administrative officer should authorize a further diversion of water, manifestly so injurious to Canada, against Canadian protest."

This decisive language, amounting to specific findings of fact upon the main contentions urged against the doings of the Sanitary District, has added significance in the light of the stipulation contained in Article 28 of the Treaty of Washington. Article 28 reads as follows:—

"The navigation of Lake Michigan shall also . . . be free and open for the purposes of commerce to the subjects of her Britannic Majesty, subject to any laws and regulations of the United States or of the States bordering thereon not inconsistent with such privilege of free navigation."

This Treaty is, of course, still in force. Some of its provisions have been wholly executed while others are still in force under concurrent legislation of the high contracting parties, or have been translated into sections of the Treaty of 1910 in phraseology conforming to present-day conditions. The Treaty of Washington was the result of the labours of that important Convention concluded at Washington 8th May, 1871, between the United States and Great Britain. Primarily the Convention was assembled for the purpose of endeavouring to reach a settlement of the claims of the United States generically known as the "Alabama Claims," arising out of the Civil War. Having reached a basis for the adjustment of the "Alabama Claims," the Convention proceeded to effect an "Amicable Settlement of all Causes of Difference between the Two Countries." Provisoes were inserted dealing with the Atlantic fisheries question, with the transit-of-goods-in-bond by rail and water, with the north-west boundary dispute, and finally, and vitally for Canada, with the navigation of the Great Lakes, the Canadian system of canals and the St. Lawrence River sea channel through the Province of Quebec to the ocean.

It is in virtue of the stipulations of this Treaty that:—

"The navigation of the St. Lawrence River, ascending and descending, from the 45th parallel of north latitude, where it ceases to form the boundary between the two countries, from, to and into the sea, shall forever remain free from and open for the purposes of commerce to the citizens of the United States." (Article 26, Treaty of Washington.)

Further also, in virtue of the undertakings of this Treaty, the citizens of the United States "secured"

"the use of the Welland, St. Lawrence, and other canals in the Dominion on terms of equality with the inhabitants of the Dominion." (Article 27, Treaty of Washington.)

Reciprocally the same rights to the use of the canals and boundary waters of the United States were bestowed upon inhabitants of the Dominion, while the United States undertook to use its good offices to prevail upon individual States owning water and canal routes tributary to boundary waters

to accord the free use of these in like manner to the inhabitants of the Dominion. Parenthetically it may be here noted that the only reciprocal advantage which the United States was then, either directly or through the exercise of its good offices, in a position to bestow upon the Dominion was the use of the Sault Ste. Marie locks and the Erie Barge canal. The former were in due course thrown o, if to Dominion shipping, but the good offices of the United Statespenever exercised, failed to prevail with the State of New York in respect to the Erie Canal, though its free use in like manner was clearly in contemplation as a moving consideration.

Yet the operations of the Sanitary District of Chicago, if suffered to be pursued, threaten not only the rights acquired by the subjects of Her Britannic Majesty to the free and open navigation of Lake Michigan, but the impairment, if not the destruction, of the entire system of the Great Lakes and river navigation, their "navigable capacity," as Mr. Secretary Stimson puts it, from the heart of the Continent to the open seas.

It is pertinent also to observe that in the current discussions regarding this matter it is loosely assumed that the diversion is "legal" up to the limit of the quantity of water fixed in the permit of the Secretary of War, of December 5, 1901, viz. 4,167 c.f.s., which is the actual existing authorization. As between the United States Government, the State of Illinois and the Sanitary District this may be the case; but (except for courteous notification, by the Secretary of War upon a few occasions, of pending hearings before him) the Canadian and British Governments were not formal parties to any of these proceedings.

It will not, therefore, be contended that they or either of them are in any sense bound by anything which was done. To such extent as it was competent, if at all, for the United States Government to sanction the diversion of the international waters of the Great Lakes out of their ancient courses, the Sanitary District has had warrant up to the limit fixed and may be considered to have proceeded in good faith. But beyond that limit, and in the face of the categorical warnings,

first of Mr. Secretary Taft, next of Mr. Secretary Root, again of Mr. Taft (before whom the question came in his quality of President), and lastly of Mr. Secretary Stimson, the Sanitary District has given its methods the aspect of a stealthy design, by opening up the sluice gates of the Great Lakes, little by little, year by year, to create a basis of claim analogous to that which would arise in law by prescription. Formal protests, it is true, were lodged, but the British and Canadian Governments relied, and were entitled to rely, upon the determination so repeatedly and explicitly expressed by the Federal Government at Washington, which alone had jurisdiction to deal with and exercise control over one of its nationals in respect to this international question. Here, however, is the Sanitary District view (See "Memorandum," pp. 31 and 32) as to how an international right may arise and become established:

"The construction of the Drainage Canal was given the greatest publicity. It was inspected by eminent engineers, representatives of the Federal Government and of Foreign Powers, delegations from various states of the Union and from civic bodies. All phases of the project were widely discussed in the public press and in technical journals. The construction of the North Shore and the Calumet-Sag Channels was given the same publicity. **The Main Drainage Canal is the most expensive and the most important link in the Waterway from the Great Lakes to the Gulf of Mexico. Its capacity of 10,000 c.f.s. makes it a help and not a hindrance to navigation.** While it was being constructed no hint was given from any source that it could not be used to its full capacity; that it should be completed and rank almost as one of the wonders of the world and then be used to only 41.67 per cent. of its capacity."

An elaborate and specious effort is made in the "Memorandum" (See Appendix A. and "Compiled Reports. Printed by Order of Parliament—1914") to link up the authorizations for power diversions at Niagara and the provisos of the Boundary Waters Treaty respecting the same with the proceedings at Chicago and to fix assent in relation to the latter upon the Canadian Government. There are copious citations from reports of the Canadian Section of the International Waterways Commission as well as from joint reports of the

Commission upon which inference is based that the Chicago diversion was acquiesced in by these bodies; and that since the documents were "printed by order of Parliament" the Canadian Government is estopped. It is argued that these casual expressions of opinions, observations, and alleged recommendations later became the basis of, and were even incorporated in, the actual Boundary Waters Treaty of 1909. It should scarcely be necessary to point out that departmental documents, interim reports, even recommendations of high officials acquire no sanction by being presented and tabled in Parliament. They are merely *obiter dicta* which may be adopted, rejected or ignored by Parliament. The inutility of the Sanitary District's argument is the more apparent when actual examination of the Treaty discloses that Chicago is not mentioned though the Niagara situation is specifically covered.

In the enthusiasm growing out of one of its great civic undertakings in other days it is said that the City of Chicago set up as its guiding Goddess a great Amazonian figure of defiant and imperative mien bearing the inscription "I WILL." Such appears to be the slogan and the temper in which this great problem is being approached by the Sanitary District.

For the Sanitary District was at no stage deterred in the pursuit of its programmes by either the denials of its applications for leave to enlarge its diversion of lake waters, or by the implications contained in the declarations of the Secretaries as to the international complications which might be created for the United States Government. All steps have been taken in carrying out the original design, for enlarging its scope commensurate with the growth of population, and even in expanding the enterprise into an extensive water-power development based solely upon the possession of these unlawfully diverted waters. Construction of what is called the Calumet-Sag Channel was proceeded with, provision thus being made for tapping the lake waters at another point remote from the original Chicago River channel.

Recently a still more ambitious project has been launched, viz., that for the construction of a nine-foot ship canal from

Lake Michigan to the Mississippi River, utilizing the Sanitary District channel and the Illinois River as its course. Besides the measure called the Madden Bill, which, without more, authorizes the diversion without limitation of time of 10,000 c.f.s. for dilution, there is at present before Congress the measure called the McCormick-Hull Bill, appropriating public money for the ship canal construction and likewise authorizing the diversion into the canal in perpetuity of 10,000 c.f.s. of lake water.

The completion of this Ship Canal Scheme, sometimes described as the Illinois State Canal, it is plain contemplates the diversion not of 10,000 c.f.s. but progressively of much larger quantities, so competent engineers think. A rival waterway designed to make Chicago an ocean port and to draw traffic from the Lakes, St. Lawrence and Erie Canal systems is to be created. Upon this more expansive phase of operations provided for by the McCormick-Hull measure and by previous enactments of the Legislature of Illinois, Chief Engineer Kelly, of the Sanitary District, has made a comprehensive statement. Here it is:—

“The drainage canal was constructed as a ship canal through the rock across the divide between Lake Michigan and the Mississippi River, the most expensive and most important link in a waterway from the Great Lakes to the Gulf of Mexico. The cost of the navigation features of the dilution project has been about \$30,000,000. The State of Illinois is now constructing a nine-foot waterway from the end of the Chicago Drainage Canal to the navigable water in the Illinois River near LaSalle. From LaSalle to the mouth of the Illinois River the depth is now seven feet, and from that point to Cairo the depth of the Mississippi River is now eight feet, whereas the Government projects in the Mississippi below Cairo and in the Ohio River above Cairo provide nine-foot depths. The McCormick Bill provides for a nine-foot waterway from LaSalle to Cairo, to be constructed at the expense of the Federal Government. The cost of such a waterway in the Illinois River with a flow of 10,000 c.f.s. from Lake Michigan is reasonable. With a flow of around 4,000 c.f.s. from Lake Michigan the cost is prohibitive. The Bill also provides that the Sanitary District of Chicago shall pay the cost of regulating works which will restore lake levels.”

In the "Memorandum" (pp. 12 and 34) it is further urged that:

"the diversion from Lake Michigan at Chicago benefits navigation in the Mississippi Valley. A flow of 10,000 c.f.s. through the Drainage Canal will not only raise the low-water stage of the Illinois River but will raise the low-water stage of the Mississippi River between St. Louis and Cairo approximately one-half foot. To increase and maintain the low-water depth of the Mississippi River at this place by any other means would cost the Federal Government many millions of dollars. . . .

"The great contribution of the Sanitary District in aid of navigation is an element to be given great consideration."

Neither Montreal nor the Province of Quebec will object to it as a commercial operation, nor indulge in any vain apprehensions as to its possible consequences. As projected it is at most a 10-foot channel from Chicago to the Gulf of Mexico using a channel for several hundreds of miles—the Mississippi—which from time immemorial has regularly overflowed its banks in the season of flush water, while in seasons of low water its courses have been choked with silt. The Erie Canal even, having a nominal 12-foot draft, is not able to sustain the position marked out for it as a commercial waterway in the face of competition. Science and engineering and capital can indeed do much in these days—almost everything but repeal the decrees of nature. These go on registering inexorably, and not even Chicago's valiant and intrepid motto, "I WILL," can prevail against them. So that those concerned in and charged with safeguarding the commerce of the Port of Montreal will be acquitted of approaching the discussion of this subject on the basis merely of anxiety for local interests. The Port of Montreal will not consume effort nor energy to resist these vain and futile aspirations, but it can be said decisively that the temper of the British and Canadian peoples will not brook designs in any quarter which put in jeopardy the safety and the sufficiency of the Lakes and St. Lawrence route in any detail of its development, whether in respect to a minor harbour on a remote lake of the chain or the deep-sea channel from Montreal to the ocean.

For lack of complete knowledge and consideration it is sometimes indecisively asserted in the discussions that the position and rights of the Canadian people in respect to the Great Lakes-St. Lawrence waterway rest upon Treaties made either because of fear, favour or affection. Once and for all it should be clearly affirmed that the control, use and navigation of all of the waters of the chain of Great Lakes and



AIRPLANE VIEW OF CENTRAL SECTION OF PORT

of their ancient and natural outlets to the open seas rest entirely and exclusively and unequivocally upon sovereign ownership and dominion, which came into being before the organization either of the Dominion of Canada or the United States of America. There is no room, therefore, for equivocation or controversy over words and phrases or their application.

The passage of both of these measures is being stoutly resisted before the Committee of Congress dealing with them by several of the States concerned, including Wisconsin, Michigan, Ohio, Pennsylvania, Indiana, and New York, as well

as by the Province of Ontario and by a large number of lake cities and miscellaneous public and shipping bodies and corporations. The eleven Representatives in the House from the State of Wisconsin submitted a joint memorial of protest against the McCormick-Hull Bill on the ground of "common right and justice," their spokesman adding that he thought passage of the bill would be in violation of Article 2 of the Boundary Waters Treaty, 1909. At the present writing it seems improbable that the proponents of these measures can overcome the storm of opposition raised against them now that it is realized how serious is the menace. It is seen that these demands of the Sanitary District for dilution purposes alone are cumulative, and that, if now assented to in principle, there will remain no means of setting any limit to them even in the imminence of the calamitous lowering of lake and river levels.

There appears to be a view prevalent that, if passed by Congress, their constitutionality would be sustained by the Supreme Court as against the obligations of existing Treaties. In such event the only other alternative would be the invoking of international agencies to procure the restraint of so serious and dangerous a robbery.

The physical consequences of this illegal procedure as carried on by the Sanitary District so far as it has gone are highly suggestive of the magnitude of the disaster in store for every harbour on the international waterway if that body is allowed to work its will.

The late Sir John Kennedy, during his service as Consulting Engineer to the Harbour Commissioners, investigated this phase of the problem and, amongst other observations, stated:—

"After the opening of the drainage channel in 1900 a cycle of high water on the Great Lakes followed, and the effect of the abstraction of water by the drainage channel was therefore not seriously felt by navigation interests; but in 1909 a cycle of low water commenced which affected navigation and drew attention to the fact that it was further injuriously affected by the abstraction of water through the Chicago drainage channel." . . .

"Much injury was actually caused to navigation by the lowering of lake and river levels from the abstraction of water at Chicago, in addition to such lowering as had occurred from natural causes. . . . The International Waterway Commission is quoted as having estimated that for six inches of artificial lowering this loss would amount to \$1,500,000 per annum to shipping interests." (See Third Progress Report, December 1, 1907.)

Professor A. P. Coleman, Head of the Geological Department of Toronto University, in a recent address, said:—

"This canal has taken about five inches of water away already, and when it takes five more all harbours will be influenced by it and all our canals when water is at low level. This was a very serious matter. It was even possible that the whole of the upper lakes could be drained past Chicago into the Mississippi, the old route taken about one thousand years ago."

The statement of the Sanitary District in the "Memorandum" (pp. 25 and 26) is sufficiently conclusive upon this head. It is as follows:

"It has been estimated that a diversion of 10,000 c.f.s. from Lake Michigan at Chicago would have a maximum lowering effect on Lakes Michigan and Huron of five and one-half ($5\frac{1}{2}$) inches. Its effect on the levels of Lakes Erie and Ontario would be a lowering of approximately the same amount. To compensate for any lowering effect caused by the operation of the Chicago Drainage Canal or of the Dilution Project, the Sanitary District offers to pay for the construction of Regulating Works in the Niagara River at the outlet of Lake Erie and in the St. Lawrence River at the outlet of Lake Ontario. It does not suggest regulating works of any particular type, but will collaborate in any scheme which the United States Engineers think advisable, and will design for comparison and study various types of such works."

It is urged that the interests of navigation in the upper St. Lawrence River and the Lakes could be preserved by this method. Even so, the case of the lower river and ship channel from Montreal to the sea would remain to be provided for. By no system of jugglery can the waters of the Great Lakes, in volume to fill a drainage or barge canal to a depth of ten feet, drawn and carried into such canal, thence into the Mississippi River and on to the Gulf of Mexico, be made to flow

again into the St. Lawrence ship channel. Lacking these waters, it is obvious that the water levels required to sustain the shipping and commerce of this Port as developed through many decades and now established cannot be maintained.

MONTREAL—SOUTH SHORE BRIDGE

Soon after the installation into office of the present Commissioners early in 1922, this question was pressed upon their attention by many interested individuals and agencies, some of whom had been, during many years, promoting or otherwise seeking to advance projects for improving communication between the City and the South Shore. Though the Harbour Board had an interest, insofar at least as the safety of navigation and shipping might be affected, it was not clear that there was legislative authority under which it could claim jurisdiction to deal affirmatively with any phase whatever of such undertaking. Concurrently the alleged urgency of the case was being diligently pressed upon the Federal Government.

In these circumstances the Honourable the Minister of Marine and Fisheries requested the Board to take up an investigation of the whole situation, especially having regard to its relation to the interests of the Harbour, and to make surveys, soundings and borings, so as to determine the most safe and suitable site, and to prepare preliminary or suggestive designs and plans, all for the information and guidance of the Commissioners and of the Federal Government.

On August 14th, 1922, after consideration of a tentative estimate of the cost of carrying out such programme, the Committee of the Privy Council of the Dominion of Canada concurred in an appropriation of the sum of fifty thousand dollars (\$50,000) of funds of the Harbour Board to be expended for these purposes.

It appeared to be the consensus of opinion at that time, in the light of then available facts, that any structure located across the lane of ship travel into and from the Harbour docks, that is to the east of McGill Street, either would be likely to

endanger navigation, or, in the alternative, might be prohibitive in cost. In initiating its investigation, therefore, the Engineering Department was instructed to confine itself to the area lying above McGill Street, and, for the time being, to exclude consideration of any other possible sites. Whilst thus proceeding it was intimated to the Commissioners by the Minister that a progress or interim report would be acceptable for the information of Parliament, which was then—that is in the early months of 1923—in Session. Under date of May, 1923 the following tentative report was accordingly forwarded to the Minister:—

“Pursuant to intimation communicated to the Harbour Commissioners of Montreal, the Commissioners have carefully considered the data accumulated by them upon the subject of the proposed bridge to the South Shore from the City of Montreal, which data consists of the Report of the Consultative Board of Engineers made in 1909, together with the Report, Maps, Plans and Tables of estimates submitted by the engineers instructed by them to make a detailed survey and investigation of the whole position under authorization received from your Department under date August 14th, 1922; and I now herewith report the conclusion and recommendation which the Commissioners have unanimously reached.

Reference to the Report of 1909 and the present Report and Tables of Estimates of 1923 (which with maps and plans accompany this letter) will show that two schemes, as they were called, of development were worked out by the engineers; which they have designated scheme “A” and scheme “C.”

Scheme “A” contemplates a project for linking up the North and South Shores over a line of communication exclusively under the Commissioners’ control; the provision, not alone of a highway bridge for vehicular traffic, but of tram tracks, and ultimately a railway bridge if and when required.

Embraced in this project is the development of St. Helen’s Island into a modern public park accessible from both shores by the entire populace.

The theory of scheme “A” is that the bridge project should be dealt with as a component part of Harbour development.

Three alternative designs have been submitted under this scheme, the estimates of cost covering which are fixed at sums ranging from a minimum of \$7,000,000 to a maximum of \$11,000,000.

Scheme "C" contemplates erection of a highway bridge immediately below and alongside the existing Victoria Bridge. A clear roadway of about 30 feet in width would be provided affording ample facility for vehicular and foot-passenger traffic. The estimates which have been made fix the cost of scheme "C" at about \$3,000,000.

The theory of scheme "C" is that the bridge project may be carried out with only incidental regard for possible future Harbour development.

The Commissioners, having as their first concern the interest of the Harbour and the necessity for conserving the safety and facility of shipping, excluded from consideration at the outset any suggestion for bridging the ship channel at a site below St. Helen's Island; and likewise the suggestion of a tunnel. Either project, it is believed, would be prohibitive in cost and would, moreover, involve the introduction of factors affecting the development of the Harbour, the consequences of which could not be foreseen. Their consideration was, therefore, confined to the projects for bridging above St. Helen's Island, either one of which may be executed without impairing any present or possible future Harbour development.

The points which may be urged for as well as against schemes "A" and "C" are set forth in the memoranda of the engineers and need not be here recapitulated.

It is, however, opportune to note, in respect to the alternative design in scheme "A," which involves reaching the city shore at McGill Street by means of a span from the Guard Pier, that the Commissioners are definitely of the conviction that the necessity imposed by this design of recasting the entire canal basin and portal, with the great cost which this would inevitably entail as well as the dislocation of shipping which would result, precludes this design from serious consideration in any case.

The Commissioners are of the opinion that every present, and every probable future need for years to come required to be served by the provision of a vehicular and foot-passenger bridge will be quite adequately met by the adoption of scheme "C."

They have reached this conclusion, and now recommend it for the following, amongst other reasons:—

(1) Such traffic congestion to the South Shore as is now complained of (and it is, in the opinion of the Commissioners, immediately acute) will be relieved and the normal probable needs of the future for a considerable period will be provided for.

(2) The capital outlay proposed is within limits which conform to standards of economy and retrenchment now needing to be enforced.

(3) The participation of the municipal and provincial bodies concerned may be more readily secured than if the more ambitious, and consequently more financially burdensome project were undertaken.

(4) So far as they are able to see into the future, the interests of the Harbour Commissioners in the bridge development will be fully conserved if running rights over such railway tracks as may be ultimately embraced therein are reserved to them for their terminal railway, so as to insure the terminal railway independent access to Harbour sites on the South Shore.

(5) The collateral features in the case of scheme "A," namely, the public park development and the provision of transit facilities thereto and therefrom, though impressive and attractive, are strictly municipal or provincial undertakings. Upon due consideration the Commissioners feel bound to report that they could not propose the participation of the Harbour Board in outlays of public monies upon a large scale for works of this description which are essentially of a non-productive character.

(Signed) W. L. McDUGALD,
President."

In submitting their tentative conclusions and recommendations above set forth it may be opportune to observe that the Commissioners considered that they were dealing with this important problem primarily as custodians of the navigation interests of the Port of Montreal. They were, therefore, imbued with the strictly utilitarian needs and aspects of the problem and with the necessity of fixing definite limitations in cost and in the extent of the facilities to be presently provided.

What occurred subsequently is set forth in a letter of the President read by Mr. Fennell at a public meeting for considering this question, held at Sorel, December 22nd, 1923, under the auspices of the Chamber of Commerce of that city and the Union of Municipalities of the Province of Quebec. Mr. Fennell exhibited to the meeting a coloured drawing of a proposed trestle bridge, which was under consideration by the

Commissioners, which would extend from Delorimier Avenue, at a level just below Dorchester Street, to and across St. Helen's Island, thence to the South Shore, with spans sufficiently above the water level between the City Shore and the Island so as to ensure no impediment to the channel. Dr. McDougald's letter follows:—

“A few days ago, in response to an invitation sent me by the Secretary of the Union of Municipalities of the Province of Quebec, I wrote intimating my intention to be present at the meeting of Members of the Union at Sorel on Saturday, the 22nd instant, for the purpose of considering a resolution, urging the Government to immediate action in the matter of the construction of a Bridge between Montreal and the South Shore.

“Circumstances having arisen in the meantime which render it impossible for me to go down to Sorel on that date, I have been obliged reluctantly and with much regret to write the Secretary in that sense.

“As you, accompanied by Mr. Harvie, the Chief Engineer, are intending to be present at this important conference, it has occurred to me that it might be useful and of advantage to the delegates to have set before them explicitly what the position of the Harbour Commissioners of Montreal is in relation to the project for promoting the erection of a Bridge from the Island of Montreal to the mainland on the South Shore of the St. Lawrence River. I therefore write you this letter with the request that, if afforded a suitable opportunity, you communicate its contents to the conference.

“As is well known, this matter has been the subject of agitation in the public press, and amongst public and municipal bodies in the communities concerned for a great many years. Tentative steps have been taken, and certain investigations have been carried out chiefly, if not altogether, as I understand it, by the Board of Harbour Commissioners of Montreal. In the year 1909 a report was submitted to the Government at Ottawa, together with certain tables of estimates and maps and plans, all of which has been prepared under the authority of the Board of Harbour Commissioners. From that date until the year 1922 the matter remained in abeyance for a variety of reasons not necessary here to be set forth. In the summer of the latter year, the present Board of Harbour Commissioners, having submitted an estimate, procured authority of the Government, and also sanction of an appropriation of the sum of \$50,000 of the funds of the Board, for

the purpose of the preparation of designs for the proposed Bridge across the Harbour, and to cover the necessary soundings, surveys, borings, etc., to locate the proper site for the piers and Bridge. The Order of the Committee of the Privy Council of the Dominion of Canada respecting this appropriation, amongst others, was concurred in the 14th of August, 1922.

"The Harbour Commissioners, with the least possible delay, caused steps to be taken, in pursuance of the authority



ELEVATOR NO. 2—CAPACITY 2,662,000 BUSHEL

so given them. In due course maps, plans, and estimates in considerable detail were laid before them by their engineers and other officers charged with carrying out the necessary investigations. All of these were carefully studied and considered by the Harbour Commissioners, who, under date of May 23rd, 1923, transmitted the same to the Honourable the Minister of Marine and Fisheries, Ottawa, together with their unanimous report containing their conclusions and recommendations in the premises. I am informed that all of the foregoing material was in due course laid before Parliament by the Minister.

"Inasmuch as this Report and communication to the Minister, dated 23rd May, 1923, consisting of six typewritten pages, was aimed succinctly to set forth the relation of the Harbour Commissioners and of the Harbour of Montreal to this project, I would desire respectfully that a copy of the same, which I hand you herewith, be read by you to the meeting.

"Though the Commissioners, upon the basis of the plans and estimates before them, tentatively confined their consideration and recommendation to a project to be located above St. Helen's Island, yet they had no intention to exclude any other the feasibility of which might be able to be demonstrated by competent authority.

"Accordingly, later on during the present season the Harbour Commissioners pursued their enquiries and investigations, being anxious, to discover the best possible ways and means for meeting the public necessity which manifestly exists. The Commissioners were the more anxious to pursue their enquiries inasmuch as it was pressed upon them by many individuals and by certain public bodies concerned that the Harbour Board was the only public body which appeared to have the means and facilities for doing this, and which at the same time had at its command an appropriation of public money for carrying out the same. They were influenced, besides, by the consideration that, in any event, whatever project might be able to be brought forward under any other initiative would in the final analysis have to be dealt with by them as being one affecting the Harbour and its shipping interests.

"During the last three months methods of solving this problem not heretofore submitted for the consideration of the Harbour Commissioners or of any other public body concerned, so far as they are aware, were brought to the attention of the Commissioners by an engineering company of international experience and repute. An arrangement was entered into by the Commissioners during the month of October under which plans and estimates, based upon a new theory of location and bridge construction, so far as the needs of this local situation are concerned, are now being developed.

"The Commissioners are hopeful, indeed they feel the utmost confidence, that a feasible programme may result, and that it may be of such character and practicability as will warrant them in bringing it forward with their recommendation for its adoption and support by the governmental and municipal bodies concerned."

In the short interval down to the present writing the Commissioners have diligently pursued their inquiry with a

view to advancing the project as quickly as possible. Tentative plans and designs are in course of preparation which, when completed, it is intended to submit to an arbitral board of engineers for selection and recommendation.

MAGNITUDE OF COAL IMPORT TRADE

The magnitude of the problem of securing the needful supplies of anthracite and bituminous coal and of distributing the same in the markets of Central Canada cannot be seen in its true perspective unless the figures are presented which show the growth and development of these markets in the present century. These markets may be said, roughly, to extend from the City of Quebec to the head of the Great Lakes.

Since this territory contains no coal measures and at the same time constitutes the major industrial and thus the chief fuel-consuming areas of Canada, it is dependent for its supplies upon the facilities of the distributors for securing a steady movement of coal from the producing fields.

Disregarding for the moment the coal which comes into the Montreal area, mostly in the season of navigation, from the Lower Provinces' fields, it may be said that these markets derive their supplies both of anthracite and bituminous coal from the States of Pennsylvania, West Virginia and Ohio. Therefore the Canadian consumer in this territory is affected by conditions of labour and transport, as they develop from season to season, outside Canada, that is, in the United States; so that, as things stand to-day, agencies altogether beyond our control and even, for the most part, outside the scope of our influence, dominate so important, even vital, a matter as our domestic and industrial fuel supply.

The following figures taken from official records are, therefore, illuminating:—

Consumption of Coal in Canada				
Cal. Yr.	Canadian	Imported	Total	Tons per Capita
1901	4,912,664	4,810,213	9,722,877	1.81
1911	9,822,749	14,424,949	24,247,698	3.365
1920	14,388,541	20,815,596	35,204,137	4.079
1921	13,070,217	18,103,620	31,173,837	3.54

During the past three calendar years the quantities and value in dollars of coal imported into Canada are shown in the following tables:—

	Anthracite Tons	Value	Bituminous Tons	Value
1920	5,090,767	\$32,647,759	12,552,910	\$27,424,870
1921	4,839,559	39,058,148	15,407,996	72,339,952
1922	4,416,255	39,000,610	12,752,059	39,258,115

The last issue of the Canadian Year Book (1921) contains an analysis showing the distribution of the Canadian output for that year of anthracite, bituminous and lignite coal available for consumption out of the total tonnage produced of 16,946,764.

There were moved from places of production within Canada into other provinces from

	Tons
Nova Scotia and New Brunswick.	1,460,013
Saskatchewan, Alberta, and British Columbia.	2,335,783
Total.	3,795,796

Nor must it be overlooked that, while Canada is a heavy importer of coal, her exports, the production of Canada, are always of considerable volume, rising on a steadily ascending scale since the opening of the century. This is exhibited in the following table of exports:—

	Tons	Values
1905.	1,615,322	\$ 3,930,802
1910.	1,826,339	5,013,221
1915.	1,512,487	4,466,258
1920.	2,120,138	13,183,666
1921.	2,277,202	16,501,478
1922.	1,953,053	13,182,440

In the years 1911 and 1913 the tonnage averaged higher than in the recent years above shown, but the values were considerably less than half as much. It is also noteworthy that in no one of the war years did either tonnage or values approach the lowest totals of the last three years.

The major deduction which is to be drawn from these figures is that the domestic and industrial fuel needs of Central Canada are progressively increasing out of all proportion to the growth of population; and that they will continue increasing despite the phenomenal expansion of hydraulic electrical power and the extensive use of fuel oil.

It must be further obvious, from contemplation of the huge tonnage in the foregoing tables that, if sources of supply could be availed of other than those heretofore relied upon, vast changes must occur in the entire scheme of Canadian transport as at present organized; such changes involving in turn incalculably large new capital outlays.

By far the largest part of the import tonnage is distributed in the Central Canadian market as above delimited. A not inconsiderable part of the same reaches points of consumption over rail and water routes, while all of it is carried from centres of production by railways most of which, from pioneer beginnings, were built and connected up gradually as expansion necessitated through several decades. In many instances also they were routed and equipped for this specific service, without which they have no important value or use. Only in rare instances is the rail haul as much as 500 miles.

At the major and minor centres of distribution have been built up vast terminal storage and handling plants and equipment for degrading and distributing to wholesalers, and ultimately to dealers and the consumer, all at an incalculable capital outlay.

Having noted the extent in volume of the coal imports and consumption of Canada, the following table, showing the movement through the Port of Montreal, is of interest:—

Coal Imports Entered at Port of Montreal (Tons)

	United States	British Anthracite	Canadian Bituminous	British Bituminous	United States Bituminous
1921	25,689	5,163	763,373	248,491	.....
1922	12,048	177,630	1,260,330	531,252	28,657
1923	47,505	111,234	1,124,224	103,787	273,259

Imports of anthracite coal entered at the Port of Montreal for the most part represent consumption at that centre and not distribution; nor do the import records of the Port show total consumption there, for the reason that the major part of the coal imported from the United States arrives either all rail or is not handled through the Port. A large percentage of the bituminous coal received is distributed for ship bunkering and railway use in the territory extending as far west as Brockville and throughout the Eastern Townships of Quebec.

THE YEAR'S ACTIVITIES

In recording from year to year the achievements of the Port of Montreal, it would seem impossible to avoid the constant and ever-recurrent use of superlatives. For many years the trade of the Port was successively recounted as being "the most wonderful in its history," and when 1921 was finished, and a new era of greater activity had been embarked upon, it was then in order in the recital of the Port's work to point out how many world's records had been smashed by the grain exports of that year. With even greater emphasis was this so in 1922, in that year not only the grain records setting a mark that will stand for some time as an object of emulation to other grain shipping centres, but advances were made in various other lines of export and import business which well deserved recording. Now the season of 1923 has been brought to a close, and naturally those who follow with any interest the progress of the greatest Port in Canada will wonder in what sphere of activity, if any, the year has been remarkable. One of the purposes of this Annual Report is to enlighten all such interested ones.

The season commenced inauspiciously with a somewhat delayed opening of navigation, but no sooner had the first vessels berthed in the Port than the great sources of inland transportation which radiate from Montreal began to function in such a manner as to leave no doubt in the minds of those directly connected with the Port that the facilities provided here for the proper despatch of shipping business would again

be called upon to play a notable part. While the total tonnage of merchandise exported and imported was considerably in excess of any previous year, there was no suggestion at any time during the season of threatened congestion. The volume of business was more evenly distributed over the seven months of navigation, and although the total of 1,117 ocean vessels which reached the Port during the year is very little short of last year's figure, at no time was the Port crowded with 91 ocean vessels on any one day, as occurred in 1922. Indeed the greatest number of ocean ships in Port at one time during the season was 63, which is accountable for by the fact that the number of tramp ships chartered to carry grain was less than in 1922. The regular steamship companies, however, plying to Montreal all report gratifying increases in their freight and passenger traffic, and some new lines of trading were opened up which have been very successful. Notable amongst these were the new Pacific Ports to Montreal, inter-coastal sailings, which brought lumber and canned salmon on their trips to Montreal, and on their return voyages took large cargoes of general merchandise. One lumber firm which may be said to have originated this traffic, the British Empire Lumber Co., who operate a new and up-to-date sawmill plant on the Bickerdike Pier, brought to Montreal in this manner during the year around thirty million feet board measure, the greatest part of which was British Columbia Douglas fir.

The passenger fleets of the Canadian Pacific Steamships Ltd., the White Star-Dominion Line, the Cunard Co. and the Anchor-Donaldson Line were representative of the most modern developments in high class, oil-burning vessels, and the excellent accommodation offered by these companies is in no small measure responsible for the increasing number of United States tourists who prefer to use the Canadian route for their trans-oceanic trips.

As detailed more fully in the paragraph of this report devoted to "Shipping," the volume of trade carried by the old-established freight steamship companies to and from the Port showed a substantial increase over previous years, while a

completely new service from Montreal to Copenhagen and Baltic Sea Ports was inaugurated by the Scandinavian-American Line Ltd., carrying grain and general merchandise.

During the whole season the reports of the grain markets on this Continent indicated that buying was sluggish, but this would not appear to have at all affected exports of Canadian grain, judging by the total quantity of Canadian wheat which left Canada during the calendar year 1923. For the 12 months ending 30th November, 1923, 226,106,325 bushels of Canadian wheat were exported, as compared with 203,162,329 bushels for a similar period ending 30th November, 1922, and this satisfactory condition is borne out by the following comparative statement of the different grades of grain handled through the Port of Montreal in 1922 and 1923:—

	1922	1923
Wheat.....	83,266,642 bus.	89,566,063 bus.
Corn.....	32,248,336 “	2,221,936 “
Oats.....	14,161,382 “	13,146,496 “
Rye.....	12,756,392 “	6,991,284 “
Barley.....	6,347,541 “	7,918,426 “
Flax.....		248,102 “

The addition to the elevator property of the Commissioners of Grain Elevator “B” situate at Windmill Point, which was purchased from the Canadian National Railways in March, removed the last existing obstacle in the way of a completely unanimous and co-ordinated system of grain handling. The situation which necessitated the functioning in previous years of the Grain Clearance Board was thus removed, and both grain shippers and steamship companies were loud in their praise of the advantages which this manœuvre conferred on all those doing a grain business in the Port.

The actual physical functioning of the grain elevators was very satisfactory, and to ensure efficiency in this respect, a “flying squad” of expert mechanics was kept “on the run” as it were, ready at a moment’s notice to proceed to any point in the whole system, to repair trifling break-downs such as inevitably occur periodically during the high pressure of the summer season in the Port of Montreal.

The sources of supply to the elevators are the lake vessels and the railroads. As regards the former, those companies operating vessels on the canal run to Montreal augmented their fleets during 1923 by many fine new ships, and as a result the service to the elevators in the Port was maintained at a high average, notwithstanding serious delays occasioned by breakages in the Lachine Canal bridges and locks during the latter part of the year. The railways were in splendid shape to handle the large volume of grain moving Eastward on the harvesting of the new crop, and new records were set by both the Canadian National and the Canadian Pacific roads in moving grain from the head of the lakes. The terminal belt line system of the Commissioners was highly organized to deal with the large traffic offering, and the operation during the season of two electric locomotives over that portion of the system which has been electrified, helped to ensure the total avoidance of congestion on the wharf tracks, although there were handled during the season a total of 216,382 cars.

Perhaps because in the handling of that commodity it has reached world-wide fame, the Port of Montreal is becoming more and more prominently advertised as the greatest grain Port in the world. To the Commissioners also, both because of the heavy expenditure on capital account for which the erection of grain elevators and conveyor galleries has been responsible, and because of its vital relation to the prosperity of Canada, grain is a very important subject. But to those connected with Canadian manufactures, and to those students of political economy who interest themselves in trade movements, the statement of the Supervisor of Wharfages on another page of this report is worthy of perusal. From such a reading it will be readily seen what a variety of commodities pass in and out through the Port, and how important the well-constructed, weatherproof, and easily attainable wharves and transit sheds in the Port are to Canadian commerce, both incoming and outgoing.

During 1922, by joint order of the Ministers of Marine and Fisheries and of Railways and Canals a committee was

appointed to study the elevator facilities controlled directly or indirectly by the Departments of Railways and Canals and of Marine and Fisheries, and to review the elevator accommodation at the various Ports mentioned in the report for the purpose of ascertaining whether additional facilities were necessary, and if so, where their provision would result in the greatest advantage having regard to the general movement of grain through Canadian Ports in its broad aspects.

Amongst their recommendations, this Grain Elevator Committee urged "that the storage facilities at Montreal be at once increased by three million bushels in the expectation of the present volume of grain being maintained, and in the event of the present volume of grain being appreciably increased, a further extension of two and a half million bushels would be justified."

The Commissioners had already realized the necessity for such a step, and accordingly authorization was obtained from the Government to proceed at once with such extensions to the elevator accommodation. Elevator "B" was taken over from the Canadian National Railways on 1st March, and immediately a contract was let for the addition thereto of storage of 1,350,000 bushels, while the Commissioners' engineering staff prepared to commence on the work of extending a new conveyor gallery to the inland end of Windmill Point Basin, a distance of some 1,600 feet. By October 1st this work was sufficiently advanced to permit of loading grain over the new galleries by a temporary belt from the old house through to the new shipping house, and more than a million bushels of grain were delivered over the new belts to vessels at Windmill Point. The installation of machinery in the new house was continued during the winter, and after the close of navigation the storage annex was emptied of grain, and was turned over to the construction forces, who immediately began the work of linking up the new bins with the old lay-out serving the elevator proper, and its original annex.

Even more outstanding in its importance to the Canadian export grain business is the erection, in the eastern section of the Harbour, of Grain Elevator No. 3. A complete technical

and engineering record of this structure is given in this report, so that it will be sufficient to mention here that the location of this latest facility has been carefully chosen, so as to provide ample room for further development in future years. One large grain elevator is more economical than a number of small ones, because of the possibility of centralizing the operating staff, and of grouping the receiving and shipping machinery in the most efficient manner, and if and when the business of the Port becomes so great as to warrant it, Grain Elevator No. 3 will be capable of having storage units added up to a total capacity of fourteen million bushels, which will constitute the largest grain storing structure in the world. In the meantime, however, and in accordance with the recommendation made by the Grain Elevator Advisory Committee, the initial storage capacity of this plant will be limited to 2,000,000 bushels, which, in addition to providing of itself valuable additional and sorely-needed storage accommodation, will, because of its location at Tarte and Laurier Piers, help to obviate congestion of shipping in the central and busier part of the Port.

In the report of the Chief Engineer, a complete description will be found of the various important subordinate works necessary to complete the "wedding"—as it were—of Elevator No. 3 with the Harbour Railway System, with the Harbour roadways, with the approaches to the city, and with the lake vessels, etc. All of these items, while not of very great magnitude in themselves, when assembled and joined with the original undertaking of building the grain elevator, combine to form a very imposing total of work.

Other important works undertaken during the year, as will be seen from the report of the Chief Engineer, include additions to the high-level shore wharves, construction of two new transit sheds, construction of up-to-date machine shop, replacing that destroyed by fire in the spring, and the construction of a new wharf office building at Victoria Pier, together with extensive dredging and paving operations, track renewals, and a further extension of the electrification of the Commissioners' railway terminals. Taken all in all, the year will be remembered chiefly because of the magnitude of constructive

operations carried on during the season, which, the Commissioners feel assured, will mark the beginning of a period of even greater activity in the Harbour of Montreal.

FINANCIAL

The Statement of Income and Expenditure for the year 1923, hereto annexed, shows Income on Revenue Account of \$3,721,159.99, an increase of \$260,349.12 from the previous year, mainly due to the increased income from the Grain Elevator System, the Railway Traffic Department and the Cold Storage Warehouse.

The cost of operation, maintenance, interest, sinking fund, etc., was \$3,630,324.86, an increase of \$435,876.70, leaving a surplus to the credit of Revenue Account for the year of \$90,835.13. The interest charges, which amounted to \$1,279,962.09, show an increase of \$141,899.97 on new loans, due to the continued carrying out of works of improvement.

The balance at the end of 1922, in the Sinking Fund Account, was \$330,680.00, to which was added in 1923 the sum of \$327,650.00, making a total of \$658,330.00. From this had to be deducted the sum of \$330,000.00 for retiring the last series of Harbour Debentures held by the public, leaving a balance at 1st January, 1924, of \$328,330.00.

At December 31st, 1923, the total Debentures outstanding amounted to \$34,290,000.00, all of which are held by the Dominion Government.

The expenditures on Capital Account during the year were as follows:—

Grain Elevator System.....	\$2,403,840.57
Wharves, Piers and Basins.....	687,996.10
Railways and Electrification.....	284,572.61
Permanent Sheds and Sawmill.....	200,262.91
Real Estate, Hochelaga and South Shore.....	125,957.00
New Plant and Shops.....	114,026.81
Electric System on Wharves and Piers.....	34,604.88
Cold Storage Warehouse.....	25,595.40
Harbour Dredging, etc.....	20,660.00
Total Expenditure on Capital Account, 1923...	\$3,897,516.28

The Total Expenditure on Capital Account to the end of 1923 amounts to \$39,406,351.23.

HARBOUR COMMISSIONERS OF MONTREAL

Statement of Income and Expenditure for the Year Ended 31st December, 1923.

Lettered
George E. Smart, Comptroller,
Montreal, Que., 25th Feb., 1924

KIDWELL, STEAD, GRABHAM & HENDERSON, *Low-molecular-weight polyethylenes*Article 12
 M. L. FOSSELL, JR.,
 General Manager and Secretary

ST. HELEN'S ISLAND PARK

With the suspension, on the 29th July, of the ferry service between the City and St. Helen's Island Park, public attention was drawn to the insecurity of the connection which places this beautiful park resort within the reach of the citizens of Montreal. Such an interruption of the service, occurring as it did in the very middle of the summer season, caused an undoubted privation to the numerous residents of Montreal for whom more distant and more pretentious recreational places are taboo. While happily the groundings and interruptions to the steamer engaged on this service, supposed to have been caused through large rocks having been carried down by the ice to the channel leading to the Island, were not attended with any serious mishap, the incident served to concentrate the attention of the public and of the Harbour Commissioners of Montreal on the vital and ever-present necessity for some more satisfactory means of access to this desirable play-ground.

Through the co-operation of the Department of Marine and Fisheries and the Harbour Commissioners, who placed engineers and tugs at the disposal of the City authorities for the purpose of making the necessary soundings and surveys for an alternative channel from Victoria Pier to the Island, the interruption to the ferry service was of short duration, but the incident served aptly to demonstrate the urgent need of the City of Montreal for such a cheap, efficient, and safe approach to their Island Park as would be furnished by the proposed Montreal-South Shore bridge.

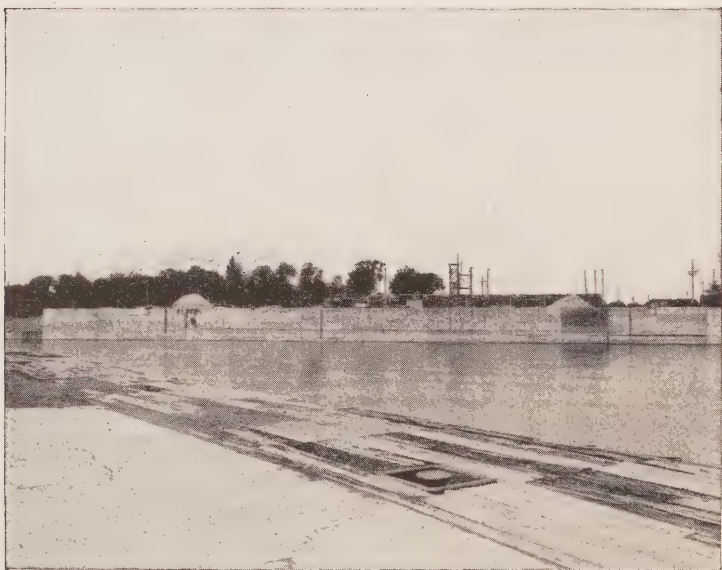
REPORT OF THE GRAIN ELEVATOR COMMITTEE

A Grain Elevator Committee, consisting of Mr. M. P. Fennell, General Manager of the Port of Montreal, Chairman; Mr. C. J. Smith, General Manager of the Montreal Warehousing Company, and Mr. R. A. C. Henry, Chief Statistical

Officer of the Canadian National Railways (formerly Special Engineer of the Department of Railways and Canals), was appointed at a joint meeting of the Ministers of Marine and Fisheries and of Railways and Canals, held at Ottawa on the 29th March, 1922.

The duties of this Committee were to consider generally the elevator facilities controlled directly or indirectly by the Departments of Marine and Fisheries and of Railways and Canals, including the elevators at Montreal, operated by the Harbour Commissioners of Montreal; the elevator at Quebec, operated by the Quebec Harbour Commission; the elevator at Port Colborne, operated by the Department of Railways and Canals, and the Elevators at the Bay Ports, operated by the Canadian National Railways.

The appointment of this Committee was brought about because of the fact that the congestion which arose in the handling of the grain offered through Canadian Ports gave rise

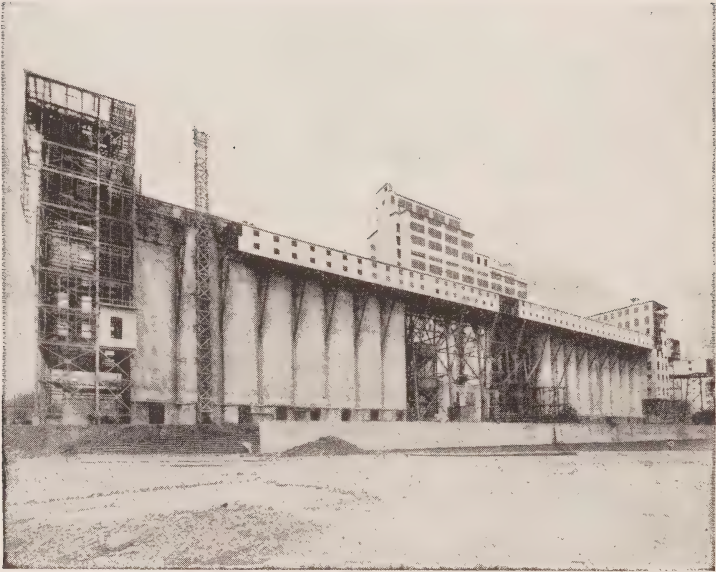


SITE OF NEW GRAIN ELEVATOR NO. 3

to application being made by the Montreal Harbour Commission for an appropriation for additional elevator facilities, and also because of proposals being made to increase facilities at Port Colborne and the Bay Ports, as well as the more extensive utilization of the elevator facilities at the Port of Quebec.

The duties of the Grain Elevator Committee involved reviewing the elevator facilities at the various Ports mentioned above, for the purpose of ascertaining whether, from the standpoint of the elevator facilities as a whole between the Lake and Bay Ports and Eastern Canada, additional facilities were necessary, and if additional facilities were necessary, making such recommendations to the Government as would result in any necessary expenditure being made at such points where the greatest advantage would be obtained therefrom, having regard to the general problem of the movement of grain through Canadian Ports in its broader aspects.

The members of the Committee visited and examined in detail the existing facilities at Depot Harbour, Port McNicoll, Tiffin, Midland, Port Colborne, Montreal and Quebec, and made an exhaustive study of grain crops, movements, and markets throughout the world, having special reference to the sources of supply in pre- and post-war years. The report is a substantial volume of some 200 pages, and deals with the physical features of the grain movement from the American Continent as it is affected by exports through Montreal, of Canadian and United States grain; the flow on the Great Lakes; Upper Lake pools; Lower Lake and Bay Ports; Upper Lake carriers; export and domestic grain; the functions of grain elevators; relation of storage to trans-shipping; rail rates to Montreal from Lake Huron; water-borne grain, forwarding to Montreal; the facilities at Buffalo, Port Colborne, and Montreal; tramps and liners in the grain trade; commercial aspects of the forwarding of export grain to Montreal; analysis of the probable effect on lake and canal rates and the location of the trans-shipping points of the construction of the new Welland Canal; and the Ports of New York and Baltimore from a grain-handling viewpoint.



ELEVATOR NO. 3—CAPACITY 2,000,000 BUSHELS—DURING
CONSTRUCTION

The conclusions arrived at in the study of these various features of the grain movement are emphasized by a most interesting series of graphs, charts, and maps, and, taken as a whole, the report of this Committee constitutes a very valuable contribution to the available literature on this important subject.

The Committee came to the following conclusions and made the undermentioned recommendations in regard thereto:—

(1) The maximum use of the elevator facilities in the movement of export grain can only be obtained by means of the closest co-operation between the various agencies involved in the transportation of grain between the head of the Lakes and Canadian Ports of export.

The best means of bringing about this co-operation is a matter which should be worked out by the various interests.

(2) The control, construction and operation of the elevator facilities at the Port of Montreal should be vested in one authority in the interests of the development of the grain movement through that Port.

The Committee recommend that this be done.

(3) During the seasons 1921 and 1922 additional storage capacity of 2,900,000 bushels would have been necessary to have completely relieved the congestion at Montreal and four or five additional berths were required for the proper accommodation of tramps.

The Committee recommend that the storage facilities at Montreal be at once increased by 3,000,000 bushels in the expectation of the present volume of grain being maintained. In the event of the present volume of grain being appreciably increased, a further extension of 2,500,000 bushels would be justified. The Committee further recommend that four or five additional berths be provided for the accommodation of tramps.

(4) The present accommodation available for liners in the central portion of the Harbour of Montreal is not sufficient to meet the requirements, and additional accommodation is needed.

The Committee recommend that additional accommodation for liners be provided from time to time as business warrants.

(5) Additional storage to the extent of 3,500,000 bushels would have been required at Port Colborne to have completely relieved the congestion at that point during the seasons of 1921 and 1922.

The Committee, however, recommend the immediate extension of the present facilities by 2,000,000 bushels additional storage capacity, feeling that under the improved conditions which are likely to exist following the extension of facilities at other points and the closer co-operation between the various interests involved the present situation will be greatly relieved by this additional storage.

(6) Additional storage to the extent of 3,000,000 bushels would have been required at the Bay Ports to have taken care of the movement of grain through these Ports during the seasons 1921 and 1922.

The additional storage of 3,000,000 bushels, however, would not have been sufficient to have taken care of any additional movement, but would merely have relieved the congestion which existed during these two seasons. To provide for a larger increase in the movement through the Bay Ports than that which took place in the two seasons referred to, storage capacity in excess of 3,000,000 bushels would be required. The Committee, however, feel that the provision of additional storage facilities at the Bay Ports might very well be left to the initiative of the interests at present in control of the elevator facilities at these points.

(7) Owing to difficulties experienced in establishing trade connections at Quebec, the elevator facilities at that point have not, in the past, been fully realized.

The Committee recommend that the various interests involved in the transportation of grain co-operate to as great an extent as possible to make greater use of the excellent facilities provided at that point.

(8) The flexibility of the elevator capacity during the rush season is governed to a large extent by the free storage period.

The Committee recommend that a reduction in the free storage period at the Lake and Bay Ports be given very serious consideration.

THE NEW GRAIN ELEVATOR No. 3

In choosing a site for the new elevator, it was found impracticable to build near either of the other elevators because of lack of space, and, furthermore, it was thought necessary to relieve congestion in the upper part of the Harbour by obviating the necessity of many boats being moved there for the sole purpose of taking grain. Since Tarte Pier is the only high level pier completed in the lower Harbour, and since the immediate future development will be in that vicinity, it was decided that the new elevator should be located there.

In the early days of the development of the Port, it was considered that Grain Elevators Nos. 1 and 2 would be able always to meet the grain-handling requirements, and the piers and railway tracks at the chosen site of Elevator No. 3 were located without regard to the future construction of a grain elevator plant. It thus happened that the elevator site was so restricted in the direction at right angles to the quay that it was necessary to adopt a layout of buildings conforming to this long and narrow area.

Elevator No. 3 consists of a car unloading shed, a receiving house, two storage houses, two shipping houses, four travelling marine towers and conveyor galleries leading to five ocean steamer berths. The main buildings are located along the wharf, between Tarte and Laurier Piers, with the car unloading shed lying on the north side and a fifty-foot roadway running along the south or quay side.

In the car unloading shed there are four car dumper machines with an unloading capacity of twenty-eight cars per hour from four tracks. Grain from cars is dumped into track hoppers, from which it is fed to belt conveyors leading through tunnels to elevator legs in the receiving house, where it is elevated to the cupola, weighed, spouted to belts and conveyed to storage bins. Provision is also made for unloading cars in the car unloading shed by means of power shovels at two tracks.

The four travelling marine towers are located on a jetty, extending out from the quay, between Tarte and Laurier Piers.

The marine towers unload grain from lake boats, weigh it and spout it to belts, in tunnels underneath the towers, by which it is conveyed to elevator legs in the receiving house, where it is elevated to the cupola, spouted to belts and conveyed to the storage bins. Receiving from boats will be at the rate of 60,000 bushels per hour on the dip.

There are two storage houses—the east storage of 1,017,000 bushels capacity and the west storage of 904,000 bushels capacity.

In shipping to ocean boats the grain is drawn from storage bins on to belts in the basement, conveyed to the boots of lofter legs, elevated to the upper floor of the shipping house, weighed and elevated to belt conveyors leading to the shipping galleries. Shipping from the east storage house is via the east shipping house, and from the west storage is via the west shipping house.

Shipping to ocean boats may be at the rate of 120,000 bushels per hour, by eight conveyors leading to the steamer berths—two on each side of Tarte Pier and one on the wharf between Tarte and Sutherland Piers. Each berth may deliver two streams of grain. Each shipping conveyor will have a capacity of 15,000 bushels per hour.

Provision is made for shipping to railroad cars from two car spouts, located in the car unloading shed, these spouts being fed either by the receiving house scales or by belt conveyors from the shipping houses.

Provision is made for building a future storage house to the north, and for future shipping berths on Laurier Pier, to the west of Laurier Pier and on and to the east of Sutherland Pier.

The receiving house, the two shipping houses, the four marine towers, the conveyor galleries and the car unloading shed are of structural steel framework with concrete floors and roofs. All of these units have corrugated asbestos covering except the car unloading shed, which has corrugated metal covering. The marine towers are mounted on car wheels and are self-propelling.

The entire plant is designed according to recently recognized principles for minimizing the hazard of dust explosion. Some of the outstanding features in this respect are the following:—

Isolation from the main building of all car unloading.

Division of the receiving house into two separate parts, connected only by elevator legs, the casings of which are vented to the outside air.

Separation of the upper part of the receiving house from the storage house by means of heavy concrete walls, the only openings through which are such as are necessary for the passing of belt conveyors, and for doors.

Location of basement boots of shipping legs in small individual houses, separated from storage basement by means of heavy concrete walls, and from shipping house by the outside air.

Separation of the shipping house from the storage house by heavy concrete walls.

Venting of all elevator heads to the outside air through the roofs, covers being provided, which, while weatherproof, will offer practically no resistance to air pressure from the inside of the elevator casings.

Venting of each bin with a vent pipe, to be run vertically from the bin to approximately four feet above the roof, with no air connection between any two bins, each bin being completely isolated from all other bins.

Ample ventilation throughout the plant, by means of windows and monitors.

The use of light wall construction, which will readily yield to internal pressure, except where such construction would permit the spreading of an explosion from one part of the plant to another, in which case heavy and unyielding wall construction is employed.

The use of non-combustible building materials.

The use of an approved system of dust collecting and handling.

It is recognized as impracticable to design an elevator to eliminate the possibility of a dust explosion, but it is thought that the precautions which have been taken in the design of Grain Elevator No. 3 will reduce this hazard to the very minimum.

EXTENSIONS TO ELEVATOR "B"

When, early in 1923, the Harbour Commissioners of Montreal purchased the Windmill Point Elevator plant, it consisted of a working house of 1,000,000 bushels capacity, a marine tower for unloading lake boats in the Lachine Canal Basin, a storage house of 1,150,000 bushels capacity and shipping galleries to two ocean steamer berths in the Windmill

Point Basin, each berth being served with one stream of grain. The plant also included a car dumper, the construction of which was then only nearing completion, this unit having been commenced by the former owners as part of extensions which they had in mind.

Immediately after purchasing this elevator plant, the Harbour Commissioners embarked upon a programme of extensions by which it was possible to triple the shipping



AIRPLANE VIEW OF WESTERN SECTION OF PORT, SHOWING
CANAL ENTRANCE AND ELEVATOR "B"

capacity. This programme involved building an addition to the storage house, a shipping house at the west end of the storage, shipping conveyors to four ocean steamer berths served by four streams of grain emanating from the new shipping house, a new marine tower to the west of the old tower, an addition to the existing working house cupola and a new power house located between the working house and the storage.

The addition to storage house consists of thirty-two circular bins of 32,000 bushels capacity each, four square bins of 18,000 bushels capacity each and fifteen interspace bins, making a total capacity of 1,250,000 bushels. The conveyors in the basement and in the cupola are re-arranged for convenient inter-communication between the working house and the storage. An old elevator leg and scales were removed from the old storage and an old cupola was demolished, since, with the new arrangement of conveyors, both below and above bins, this leg was practically of no value, and, further, since the construction of the old cupola was such that it was considered dangerous from the standpoint of dust explosion. The construction of the addition is entirely of reinforced concrete, except for the beams supporting the floor over the bins, which are of steel.

The shipping house contains four legs for elevating from the storage basement belts to scales from which the grain is spouted through garnerers to the shipping conveyors.

The shipping conveyor system consists of three galleries—one extending from the shipping house to a drive tower on the wharf and two extending along the wharf for a total distance of approximately 1,600 feet. Each of the two wharf galleries is equipped with two conveyors, so that four streams of grain may be delivered simultaneously. Each shipping conveyor has a capacity of 15,000 bushels per hour.

The new marine tower is located with the marine leg 72 feet west of the marine leg in the old tower, with provision for moving the tower 10 feet east or west from this central position to allow for boats which vary from the standard 24 feet hatch spacing. The tower is mounted on car wheels, and is moved by cables anchored to the wharf and wound on a hauling drum in the tower.

The addition to the working house cupola is located at the north-west corner of the existing working house and contains two new elevator legs and two new scales. There are two new belt conveyors extending from the working house to the storage, and one new belt conveyor extending from the east end of the first storey of the working house to the new elevator legs at the west end.

The shipping house, shipping galleries, marine tower and addition to working house cupola are all of structural steel framework, with concrete floors and roofs with corrugated iron siding.

The power house is a reinforced concrete structure, in which are installed the switch-boards and control panels for all the electric power, lights and signals throughout the plant.

In all of the new construction, precautions were taken to minimize the hazard of dust explosion.

SHIPPING

The record of the Shipping services to the Port of Montreal during the season of 1923 is in every respect a creditable one, and the satisfactory showing of the Steamship Companies operating vessels to trans-Atlantic points, and also of the inland vessel owners, was attributable, in part at least, to the excellence of the accommodation which has for many years past been provided for freight and passenger requirements at the Port of Montreal. That the volume of shipping entering the Port during the past season did not show any increase over that of 1922 is due solely to the falling off in the number of tramp ships which visited Montreal to take full cargoes of grain. Where the liners were concerned, the number of sailings of the Canadian Pacific Steamships Ltd., the White Star-Dominion Line, and the Cunard and Anchor-Donaldson Line, was considerably greater than during the previous season, and the passenger business of the St. Lawrence route during 1923 showed a noticeable improvement over previous seasons.

The opening of navigation in 1923 was disappointingly delayed because of the severity of the end of the winter, and the schedules of sailings which had been arranged in advance by the Steamship Companies had to be altered, and several of the first sailings to the Port were cancelled when it was learned that the ice conditions in the River and Gulf were still too severe to permit of navigation, the vessels being diverted to St. John and Halifax. The first vessel to arrive

in Port in 1923 was the S.S. "Bolingbroke," of the Canadian Pacific fleet, which ship berthed at 3.30 p.m. on May 4th, and her Commander, Captain Edmund Aikman, was awarded the usual trophy of a gold-headed cane, presented by the Harbour Commissioners, on board his ship. The reverse condition to that prevailing in the spring was experienced at the close of navigation, when the river remained open, without any trace of ice, for several weeks after the last ship had sailed.



ELEVATOR No. 1—CAPACITY 4,000,000 BUSHELS

Detailed statistics of the numbers and tonnages of vessels trading to Montreal during the season are to be found at the end of this volume, from which it will be seen that the number of ocean-going vessels (including ships from trans-Atlantic ports and Maritime Provinces) was 1,117 ships, with a total net registered tonnage of 3,728,740, as compared with 1,194 ships of 3,932,637 net tons in 1922. The number of inland

vessels was 5,609, amounting in tonnage to 8,195,308, making the total number of ships for the year 6,726, having a net tonnage of 11,924,048. The greatest number of vessels in Port during the year occurred on 23rd May, on which day there were 63 ocean vessels and 52 inland vessels scattered around the Harbour. Ships of eighteen nations were to be seen at the piers and wharves in the Port during 1923, the vast majority of which, 836 in number, and with a capacity of 2,979,660 net tons, were of British registry. The following nationalities were represented by their merchant marine in the following order:—Norway 77 vessels, America 57, Italy 30, Denmark 27, Holland 22, France 16. Amongst the points of interest in this connection was the arrival in Port during the year of 10 Japanese vessels, which was the more remarkable in that only one ship of that nationality had ever previously visited the Port. The Free City of Danzig sent 14 ships. There were two German vessels, the first since 1914, one ship from Latvia, and a gunboat from Cuba which was proceeding up the Canal to attend the Toronto Exhibition.

The warships of the British North American squadron, the "Calcutta," "Capetown," and "Constance," the first named flying the flag of Vice-Admiral Sir Michael Culme-Seymour, spent two weeks in Port at the end of August, and while moored at Laurier Pier were the centre of attraction to large numbers of Montrealers, who inspected them on every available opportunity. Other martial vessels to be seen in the Harbour during the year were the French warships "Ville D'Ys" and "Regulus," the United States training ship "Wilmington," and the Cuban gunboat "Patria."

The outstanding features of the ocean Steamship Companies in recent years have been the imposing number of fine new ships which they have added to their fleets, and the greatly augmented number of sailings from Montreal which have characterized their operations. The Canadian Pacific Steamship fleet has been kept up to the high standard demanded by the cut-throat competition in the ocean carrying business, and amongst their St. Lawrence fleet are the fine vessels the

"Montcalm," "Montclare," and "Montrose," while during 1923 they added yet another to their "M" class vessels, the S.S. "Montlaurier." During the past season this Company had considerably more sailings to Montreal than in 1922, and carried 139,597 passengers. The White Star-Dominion Line reported increases in both their passenger and freight business. New tonnage was introduced on the Montreal route by this Company also—the S.S. "Doric," a sister ship of the "Regina," 16,500 tons, and one of the largest vessels which come to Montreal. This Company had 28 Eastbound sailings to Montreal during the season of 1923, carrying over 7,000 passengers, and on their Westbound sailings brought to Canada 22,000 passengers. The White Star-Dominion Line operated their usual freight sailings from Montreal weekly to Liverpool and fortnightly to Avonmouth, and while the volume of general traffic fell short of their expectations, their record in this respect was satisfactory in view of the depressed conditions existing all over the world in the steamship business. The allied lines operated by the Robert Reford Co., the Cunard and Anchor-Donaldson, experienced an exceptionally good year. For 1924, however, they have provided an addition to the Montreal fleet of the Cunard Line, the S.S. "Ascania," which will operate in conjunction with the "Andania," "Antonia," and "Ausonia." In 1923 the combined sailings of these two companies to St. Lawrence Ports totalled 104, which compares very favourably with the 70 sailings in 1922.

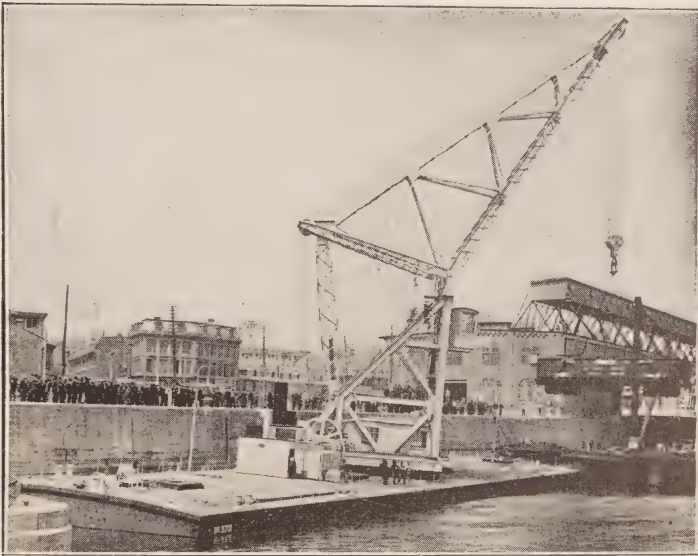
The outstanding note, where the freight steamship companies are concerned, is their general endeavour, by providing new tonnage, and by opening up new lines of trading, to co-operate in the future, as they have done so consistently in the past, to serve Canadian inbound and outgoing trade. The Furness-Withy Co., operating the Furness Line and the Manchester weekly sailings, specializes in fast services to British Ports for perishable commodities, and during 1923 placed three additional ships on their Montreal service. These were the "Chickahominy," the "Appomottax," and the "Manchester Regiment." The season's business of McLean Kennedy Ltd. was in the same category as those already

referred to. They added a fine new ship, the S.S. "Torr Head," to their Irish service, kept up the sailings of the Houston Line to South American Ports, and commenced the operation of the Scandinavian-American Line, giving weekly sailings to Copenhagen and Baltic Sea Ports. Elder Dempster & Co. Ltd. placed three new ships on their Montreal service during 1923, the S.S. "Calgary," "Calumet," and "Cochrane," which have been specially designed for the South African trade, and include refrigerated capacity of 20,000 cu. ft. each. Their experience was that South African ships had not full cargoes outwards, but that country is recovering after two years of unprecedented depression, and considerable improvement in this respect is looked for in 1924. The Canadian Government Merchant Marine operated extensively in 1923, and on the removal of the embargo on Canadian cattle, fitted out their four vessels in the Cardiff and Swansea service for participation in this trade. During the season the Company made 31 sailings to the United Kingdom, 26 to the West Indies, 17 to Newfoundland, 12 to Gulf Ports, and 8 to Australia and New Zealand.

The principal charterers of tramp steamers to Montreal are Thos. Harling & Son, who handled 119 vessels in 1923. One point of interest in their business was the increasing number of full power motor vessels which were to be found on the St. Lawrence trade. Amongst several of these ships which came to Montreal during the past season were the Norwegian motorships "Strassa" and "Indra," the latter a new vessel on her maiden voyage, equipped with the very latest type of Werskpoor Deisel Engines. This Company originated a direct intercoastal service between Montreal and Vancouver, via the Panama Canal, which met with very encouraging support. There has, for some years past, been an urgent demand for such a service to the Pacific Coast, and this undertaking has enabled Canadian manufacturers, who were practically prevented from selling their products in British Columbia owing to the high rates of freight by rail, to open up new markets in that Province by taking advantage of water shipment. Messrs. Harling & Son loaded 96 full

cargoes of grain during 1923, and found the average cargo per steamer to be over 7,000 tons, an indication that the average size of freighter coming to Montreal is very rapidly becoming larger.

In 1924, McLean Kennedy Ltd. will inaugurate a further direct service from Montreal to Vancouver with four first-class steamers of around 8,000 tons cargo capacity—namely, the “Halizones,” “Harmonides,” “Harmodius,” and “Haliartus.”



75-TON FLOATING CRANE LIFTING CAR OF GRAIN

The Harbour Commissioners of Montreal have on many occasions advanced the claim that the Port of Montreal, because of its up-to-date equipment, is particularly suitable to give vessels first class service in the matter of rapid loading. An investigation conducted during 1923 of the average time in port of 69 particular vessels, all of which took full cargoes of grain, and every one of which arrived light, and fitted out in

Montreal, demonstrates the justice of such a claim. This investigation disclosed the decidedly interesting fact that the average time in port of each of these 69 vessels, from the hour of arrival until the hour of departure, was 6 days and 23 hours. When it is remembered that this included time required for fitting up before loading, and for bagging after loading had completed, it will be seen how satisfactorily vessels working on limited lay days can be handled in the Port of Montreal. In special cases, of course, where the vessel arrives ready to load, and all her grain is available, records of completing loading in as short a time as 12 hours have been set up, but an average taken from such a large number of ships is a better indication of steady efficiency, and the figures given above show that the average vessel taking grain at the Port of Montreal is loaded well within her lay days. No other American Port has been able to show such a splendid average as this.

The largest vessel which ever came to Montreal for a complete cargo of grain arrived during 1923. This was the S.S. "Gemma," which loaded 240,000 bushels at Montreal, and took on the balance of her cargo, 120,000 bushels, at Quebec.

The inland steamship business in 1923 was characterized by a striking increase in the tonnage operated on the Port Colborne-Montreal route, and it was this additional accommodation which compensated for the several serious delays to shipping which occurred during the season, caused by breakages in the locks and bridges of the Lachine Canal. In spite of these interferences, the supply of grain to the elevators at Montreal was kept up to the necessary requirements. The records kept in the grain elevators show that in 1923, 1,147 vessels brought cargoes of grain to Montreal from Port Colborne and other Lake Ports, as compared with 1,125 in 1922. In the previous season the total quantity of grain transported to Montreal by water was 85,000,000 bushels, or 54.8% of the total receipts for that year of 155,000,000 bushels, while in 1923 the water-borne receipts amounted to 75,000,000 bushels, or 62.5% of the total of 120,000,000 bushels. Six of the com-

panies engaged in this business added new ships to their fleets last year, 29 vessels in all, with a total gross tonnage of around 42,000 tons. Carter & Wood operated nine new boats of the standard Canal size, capable of carrying some 85,000 bushels of wheat. The Eastern Steamship Co. also started operations in 1923 with nine fine new ships built specially for this trade. The Geo. Hall Coal and Shipping Corporation had four additional steamers running between Lake Ports and Montreal, each of these vessels having a capacity of 77,000 bushels of wheat. The Hancock Shipping Co. added four ships to their fleet, with grain carrying capacity ranging from 48,000 to 54,000 bushels. The Keystone Transports Ltd. purchased two new vessels which they operated between Lake Erie Ports and Montreal, and the Kirkwood Line Ltd. placed the "J. H. Plummer" on the Lakes service to Montreal. In the spring of 1924 work will be commenced on the construction of a storage annex to the elevator at Port Colborne, which will increase the handling capacity of that elevator considerably, and is expected to greatly add to the flexibility of the grain carrying service from that Port to Montreal.

TRADE OF THE PORT

The Report of the Supervisor of Wharfages, which is compiled upon the conclusion of the calendar year, is of particular interest for 1923, and demonstrates aptly the manner in which the efficient operation of the Port of Montreal affects the trade of the whole Dominion. While in recent years the grain trade of the Port has grown so enormously that it now has become of preponderating importance, both in value and actual tonnage as a single commodity, it must not be assumed that the activities of the Port of Montreal are confined to some few basic lines of import and export trade, with grain in the lead. How far such an assumption would be from the actual facts may be gauged by a study of the report of the Supervisor of Wharfages, which gives the incoming and outgoing tonnages for the year of four hundred and seven different commodities.

The outstanding commodity increases for 1923 over last year are as follows:—Agricultural implements, 3,830 tons;

Automobiles, 22,307 tons; Firebricks, 6,164 tons; Cheese, 28,488 tons; Dry Goods, 5,022 tons; Flaxseed, 17,884 tons; Flour, 17,551 tons; Iron and Steel Bars, 15,716 tons; Lard, 5,989 tons; Liquors, 5,439 tons; Machinery, 5,581 tons; Meats, cured, 4,863 tons; Milk in tins, 4,288 tons; Oil in bulk, 107,041 tons; Sand, 28,437 tons; Steel Billets, 6,615 tons; and Live Stock, 7,775 head.

The following is a summary of a few of the principal articles of trade during 1923, with the import and export tonnages:—

	Import Tons	Export Tons	Total Tons
Acids.	169	3,083	3,252
Agricultural Implements. . . . .	...	10,005	10,005
Aluminium. . . . .	...	726	726
Asbestos. . . . .	...	6,347	6,347
Automobiles and parts.	719	105,748	106,467
Bolts and Nuts. . . . .	...	2,200	2,200
Books.	1,408	...	1,408
Boots and Shoes.	567	417	984
Butter. . . . .	...	2,309	2,309
Carpets.	1,381	...	1,381
Cement.	204	26,141	26,345
Cheese.	441	60,377	60,818
Chemicals.	4,443	738	5,181
Chinaware.	1,403	...	1,403
China Clay.	8,775	...	8,773
Coal (Anthracite).	158,739	...	158,739
Coal (Bituminous).	1,501,270	...	1,501,270
Cocoa.	1,479	...	1,479
Cocoa Beans.	928	...	928
Copper. . . . .	...	19,785	19,785
Creosote Oil.	11,330	...	11,330
Dry Goods.	36,958	1,264	38,222
Eggs. . . . .	...	9,252	9,252
Flour.	127	346,101	346,228
Fruit.	3,633	27,422	31,055
Furs.	140	301	441

Galvanized Tin Sheets.....	29,108	...	29,108
Gasoline.....	16,477	...	16,477
Glass.....	27,355	...	27,355
Grain:			
Barley.....	...	194,523	194,523
Corn.....	...	55,285	55,285
Oats.....	...	168,646	168,646
Rye.....	...	185,467	185,467
Wheat.....	...	2,694,160	2,694,160
Groceries.....	2,134	861	2,995
Hardware.....	1,427	1,558	2,985
Musical Instruments.....	286	853	1,139
Iron.....	21,032	11,389	32,421
Jute (Cloth and Yarn).....	2,973	...	2,973
Jute Bags.....	...	900	900
Lard.....	...	26,416	26,416
Leather.....	365	1,310	1,675
Liquors.....	12,055	4,969	17,024
Machinery.....	7,199	4,613	11,812
Meats, Cured.....	...	129,135	129,135
Meats, Fresh or Frozen.....	...	4,749	4,749
Meats, in tins.....	1,147	2,314	3,461
Milk, in tins.....	...	9,680	9,680
Oil, Petroleum.....	386,192	...	386,192
Paper.....	4,774	15,196	19,970
Phosphates.....	11,014	...	11,014
Salt.....	15,846	419	16,265
Steel.....	19,513	363	19,876
Sugar, raw.....	79,222	...	79,222
Sugar, refined.....	...	5,780	5,780
Sulphur.....	13,705	...	13,705
Tea.....	6,244	...	6,244
Tobacco.....	397	722	1,119
Vegetables.....	2,899	817	3,716
Whiting.....	7,085	...	7,085
Wire.....	10,234	10,532	20,766
Wool.....	3,858	...	3,858
Yarns.....	2,836	42	2,878

THE GRAIN ELEVATOR SYSTEM

With a total export of all grains for the season of navigation 1923 of 120,107,990 bushels, the Port of Montreal for the third successive year takes the leading place amongst the grain ports of the world. Its achievement this season has not been so much in the ability of the facilities of the Port to handle expeditiously and with 100 per cent. efficiency a maximum quantity of grain per transfer unit, but lies in the fact that when all other Ports on the Atlantic and Gulf Coast sea-board felt the pinch of a dull season, the Port of Montreal again shows a noteworthy total of grain handled, and this the Commissioners consider a tribute to the superiority of the Montreal route over all its competitors. Still another factor in the success of the Port of Montreal in 1923 lies in its good fortune to be, not an American Port, not an Australian Port, not a Russian Port, nor a Port of the Argentine, but the foremost Port in Canada, and that Canada's wheat and grain products have no equal in the markets of the world. In spite of depressed trade conditions, in spite of pessimistic rumours that Europe was not buying from this Continent, but was returning to her old love, Russian and Roumanian wheat and rye, in spite of a year of unusual stagnation in shipping circles, the portion of the Canadian grain crop of 1922 which remained stored during the winter of that year, and which moved out from the interior elevators on the opening of navigation in 1923, and the very heavy new crop which was harvested in this present season, continued to leave this country, bound for consumption abroad.

For the calendar year 1923 the exports of Canadian wheat showed an increase over 1922 of more than 25,000,000 bushels, and of the total outgoing movement, the Port of Montreal received 64,131,724 bushels, as compared with 43,193,296 bushels in 1922. When it is remembered that the Ports of St. John, Vancouver, Quebec, and Halifax also received their shares of Canadian wheat, it will be seen that the balance leaving through United States sea-board points is decreasing yearly, as the excellence of the facilities provided here in

Montreal to take care of this movement gains widespread cognizance. There still, however, went through Buffalo during the year a total of over 100,000,000 bushels of Canadian wheat, and a total to United States ports of 125,194,177 bushels, but this was slightly compensated for by the fact that the Port of Montreal received 33,704,531 bushels of American grain, mostly wheat and rye. The receipts at Montreal of American grain are considerably below those for 1922, as will be at once seen from the following comparative statement showing the quantities of the various grains received during 1922 and 1923:—

AMERICAN GRAIN

	1922	1923	
American Wheat....	31,825,493	25,434,339	bus.
“ Corn.....	32,248,336	2,221,936	“
“ Rye.....	11,756,392	6,048,296	“
“ Oats.....	1,019,862	.....	“

The difference between the 155,035,817 bushels which was the figure for 1922, and the figure for this year of 120,107,990 bushels, is accountable for by the almost complete falling off of the exports through Montreal of American corn, and the reduction to half of the exports of American rye.

The statistical tables which follow, showing the operation during the year of the three elevators belonging to the Commissioners are of interest, and a study will show that while in 1922 the busiest months were those immediately succeeding the harvesting of the new crop, during this season the volume of grain exports was maintained throughout the seven months of navigation. June and October were the busiest months with 20,000,000 bushels each, and during the balance of the season the monthly figures never fell below 14,000,000 bushels. 16,649 cars of grain were received from the Canadian National Railways, and 10,982 cars from the Canadian Pacific. At Elevator No. 1, 38,151,284 bushels were received from boats, while 9,075,775 bushels were unloaded from cars;

at Elevator No. 2 the water receipts amounted to 26,462,156 bushels, and the rail receipts to 19,271,020 bushels; at Elevator "B," 10,018,138 bushels came in by boat, and 17,129,617 bushels by railway cars. The total water-borne grain amounted to 74,631,578 bushels, and the total rail-borne grain to 45,476,412 bushels. Of the total grain receipts, 86,403,459 bushels was Canadian grain, while 33,704,531 bushels were received from the United States.

On the 1st March the Commissioners purchased Grain Elevator "B" at Windmill Point from the Canadian National Railways, thus removing the last obstacle in the way of a completely concentrated system of grain handling, and the three elevators were operated during the season as one unit. The inclusion of Grain Elevator "B" in the Commissioners' organization was welcomed by all the interests concerned in the grain business through Montreal, and incidentally obviated the necessity for the operation of the Grain Clearance Board which functioned in previous years. In another part of this report a very complete description of this elevator is given, both at the time of its purchase, and at the end of the season after the extensive additions had been made, but there is one feature of the plant which deserves especial mention, as it marks a noteworthy advance in grain-handling methods. We refer to the new mechanical car dumper, which was erected in the winter of 1922, and was operated in conjunction with Elevator "B" during the season. This installation was in the nature of an experiment, and has been a successful one, as while there have been other machines designed for the purpose of unloading cars of grain expeditiously, this particular design both in economical operation and satisfactory performance, stands out by itself. The novelty of design of this car dumper brought elevator experts from practically every port in North America at various times during the season to inspect its details, and has so satisfied the Commissioners of its excellence that four similar machines will be included in the equipment of Grain Elevator No. 3, the latest addition to the Harbour facilities, now in course of construction.

As regards the mechanical functioning of the grain elevators proper, it is only necessary to mention that the machinery was again subjected to the acid test of high-speed operation over a long continuous period, and again was equal to the demands made on it. The usual overhauling takes place during the winter months, so that at the opening of navigation everything may be shipshape for the busy season.



FREIGHT HOIST SERVING TRANSIT SHEDS

The capacity of the Harbour Commissioners' grain elevators at the opening of navigation 1924 will be as follows:

Grain Elevator No. 1	4,000,000	bus.
Grain Elevator "B"	3,500,000	"
Grain Elevator No. 2	2,662,000	"
Grain Elevator No. 3	2,000,000	"

The following are the records of the receipts and deliveries, by months, of grain at the Harbour Commissioners' Elevator system for the year 1923:—

ELEVATORS Nos. 1, 2 and "B," 1923—RECEIPTS

	Wheat	Oats	Barley	Corn	Rye	Flax	Other	Total
January.....	6,440	126,234	26,746	14,645	.....	.....	.....	174,065
February.....	30,951	63,421	15,416	1,645	.....	.....	931	112,364
March.....	5,117	114,120	48,458	7,514	1,475	.....	3,228	179,912
April.....	1,526,959	240,173	194,141	4,028	.....	.....	1,390	1,966,691
May.....	11,803,894	1,885,305	498,464	1,573,784	789,900	.....	.....	16,551,347
June.....	15,221,494	3,964,956	901,382	267,475	513,191	.....	.....	20,868,498
July.....	10,592,207	1,258,856	1,047,628	.....	1,577,056	.....	.....	14,475,747
August.....	9,575,320	1,420,422	1,931,073	99,048	1,260,905	28,268	1,170	14,316,206
September.....	11,140,169	701,766	1,138,195	129,688	2,149,104	26,829	.....	15,285,751
October.....	17,456,937	947,157	1,233,326	60,513	673,475	69,950	3,084	20,444,442
November.....	11,506,251	1,789,014	748,119	31,478	26,178	83,085	4,643	14,188,768
December.....	700,324	635,072	135,478	32,118	.....	39,970	1,237	1,544,199
	89,566,063	13,146,496	7,918,426	2,221,936	6,991,284	248,102	15,683	120,107,990

ELEVATORS Nos. 1, 2 and "B," 1923

	WHEAT		OATS		BARLEY		CORN	RYE		FLAX	OTHER	TOTAL
	Can.	Amer.	Can.	Amer.	Can.	Amer.	Amer.	Can.	Amer.	Can.	Can.	
January.....	6,440	.....	126,234	.....	26,746	.....	14,645	.....	.....	.....	.....	174,065
February.....	30,951	.....	63,421	.....	15,416	.....	1,645	.....	.....	.....	931	112,364
March.....	5,117	.....	114,120	.....	48,458	.....	7,514	1,475	.....	.....	3,228	179,912
April.....	1,526,959	.....	240,173	.....	194,141	.....	4,028	.....	.....	.....	1,390	1,966,691
May.....	7,708,499	4,095,395	1,885,305	.....	498,464	.....	1,573,784	6,910	782,990	.....	.....	16,551,347
June.....	12,132,983	3,088,511	3,964,958	.....	901,382	.....	267,475	5,118	508,073	.....	.....	20,868,498
July.....	6,790,132	3,802,075	1,258,856	.....	1,047,628	.....	.....	264,456	1,312,600	.....	.....	14,475,747
August.....	5,498,681	4,076,639	1,420,422	.....	1,931,073	.....	99,048	320,175	940,730	28,268	1,170	14,316,206
September.....	3,710,852	7,429,317	701,766	.....	1,138,195	.....	129,688	219,190	1,929,914	26,829	.....	15,285,751
October.....	14,739,132	2,717,805	947,157	.....	1,233,326	.....	60,513	125,704	547,771	69,950	3,084	20,444,442
November.....	11,281,654	224,597	1,789,014	.....	748,119	.....	31,478	.....	26,178	83,085	4,643	14,188,768
December.....	700,324	.....	635,072	.....	135,478	.....	32,118	.....	.....	39,970	1,237	1,544,199
	64,131,724	25,434,339	13,146,496	.....	7,918,426	.....	2,221,936	943,028	6,048,256	248,102	15,683	120,107,990

**SUMMARY OF GRAIN HANDLING—ELEVATOR SYSTEM
SEASON 1923**

	C.N.R.	C.P.R.	Total Cars	Vessels	Receipts	Deliveries
January.....	59	44	103	...	174,065	738,343
February....	54	21	75	...	112,364	555,281
March.....	52	59	111	...	179,912	593,675
April.....	1,331	60	1,391	...	1,966,691	558,632
May.....	3,064	2,474	5,538	115	16,551,347	14,747,224
June.....	3,621	2,913	6,534	144	20,868,498	19,148,706
July.....	1,200	535	1,735	183	14,475,747	16,072,645
August.....	693	123	816	198	14,316,206	13,782,365
September...	564	641	1,205	201	15,285,751	15,221,342
October.....	4,196	2,893	7,089	145	20,444,442	19,871,718
November...	1,769	1,156	2,925	142	14,188,768	18,099,411
December...	46	63	109	19	1,544,199	550,788
	16,649	10,982	27,631	1,147	120,107,990	119,940,130

**Summary of Grain Handling—Elevators 1, 2,
and " B "—1923**

	Canadian Grain bus.	American Grain bus.	Total Received bus.
January.....	159,420	14,645	174,065
February....	110,719	1,645	112,364
March.....	172,398	7,514	179,912
April.....	1,962,663	4,028	1,966,691
May.....	10,099,178	6,452,169	16,551,347
June.....	17,004,439	3,864,059	20,868,498
July.....	9,361,072	5,114,675	14,475,747
August.....	9,199,789	5,116,417	14,316,206
September.....	5,796,832	9,488,919	15,285,751
October.....	17,118,353	3,326,089	20,444,442
November.....	13,906,515	282,253	14,188,768
December.....	1,512,081	32,118	1,544,199
	86,403,459	33,704,531	120,107,990

**Summary of Grain Handling—Elevator No. 1
Season 1923**

	Receipts bus.	Deliveries bus.
January.....	.....	226,127
February.....	.....	134,069
March.....	.....	150,963
April.....	73,993	65,625
May.....	7,594,053	5,689,462
June.....	8,740,817	7,446,120
July.....	6,224,958	7,121,650
August.....	6,772,221	5,672,890
September.....	6,611,746	6,411,392
October.....	5,964,206	6,335,265
November.....	5,031,077	6,833,637
December.....	213,988	198,926
	<hr/>	<hr/>
	47,227,059	46,286,126

Receipts		Deliveries	
Water.....	38,151,284 bus.	Conveyor....	43,934,042 bus.
		Cars.....	1,640,303 "
Rail.....	9,075,775 "	Teams.....	710,370 "
	<hr/>	Bags.....	1,411 "
	47,227,059 "		<hr/>
			46,286,126 "

First vessel unloaded May 7th, 1923.
Last vessel unloaded December 1st, 1923.

500 steamers } 38 barges }	538 vessels—38,151,284 bus.
1,667 C.N. } 3,457 C.P. }	5,124 cars— 9,075,775 "
	<hr/>
	47,227,059 "

Canadian Grain—32,814,545 bus.
American Grain—14,412,514 "

	<hr/>
47,227,059 "	

Summary of Grain Handling—Elevator No. 2 Season 1923

	Receipts bus.	Deliveries bus.
January.....	174,065	199,922
February.....	112,364	220,543
March.....	177,978	204,185
April.....	514,119	158,260
May.....	6,434,499	6,078,178
June.....	7,922,906	7,992,466
July.....	5,326,591	5,573,123
August.....	4,805,086	4,966,907
September.....	5,979,001	6,231,956
October.....	8,130,039	7,622,932
November.....	5,344,565	6,693,708
December.....	811,963	327,854
	<hr/> 45,733,176	<hr/> 46,270,034
	Receipts	Deliveries
Water.....	26,462,156 bus.	Conveyor.... 42,805,715 bus.
		Cars..... 1,317,906 "
Rail.....	19,271,020 "	Teams..... 864,124 "
	<hr/> 45,733,176 "	Bags..... 1,282,289 "
		<hr/> 46,270,034 "
First vessel unloaded May 7th, 1923.		
Last vessel unloaded Dec. 10th, 1923.		
390 steamers } 46 barges }	436 vessels—26,462,156 bus.	
3,132 C.N. } 7,525 C.P. }	10,657 cars—19,271,020 "	
	<hr/> 45,733,176 "	
Canadian Grain—32,717,640 bus.		
American Grain—13,015,536 "		
	<hr/> 45,733,176 "	

Summary of Grain Handling—Elevator “ B ” **Season 1923**

	Receipts bus.	Deliveries bus.
January.....	.....	312,294
February.....	.....	200,669
March.....	1,934	238,527
April.....	1,378,579	334,747
May.....	2,522,795	2,979,584
June.....	4,204,775	3,710,120
July.....	2,924,198	3,377,872
August.....	2,738,899	3,142,568
September.....	2,695,004	2,577,994
October.....	6,350,197	5,913,521
November.....	3,813,126	4,572,066
December.....	518,248	24,008
	<hr/> 27,147,755	<hr/> 27,383,970

	Receipts		Deliveries
Water.....	10,018,138 bus.	Conveyor....	26,014,079 bus.
		Cars.....	1,320,641 “
Rail.....	17,129,617 “	Teams.....	44,209 “
	<hr/> 27,147,755 “	Bags.....	5,041 “
			<hr/> 27,383,970 “

First vessel unloaded May 18th, 1923.

Last vessel unloaded December 5th, 1923.

162 steamers }
 11 barges } 173 vessels—10,018,138 bus.

11,850 C.N. cars.....

 17,129,617 “
 27,147,755 “

Canadian Grain—20,871,274 bus.

American Grain—

 6,276,481 “

27,147,755 “

Summary of Grain Handling—Elevators 1, 2 and "B"—1923

	Receipts bus.	Deliveries bus.
January.....	174,065	738,343
February.....	112,364	555,281
March.....	179,912	593,675
April.....	1,966,691	558,632
May.....	16,551,347	14,747,224
June.....	20,868,498	19,148,706
July.....	14,475,747	16,072,645
August.....	14,316,205	13,782,365
September.....	15,285,751	15,221,342
October.....	20,444,442	19,871,718
November.....	14,188,768	18,099,411
December.....	1,544,199	550,788
	120,107,990	119,940,130
Water.....	74,631,578 bus.	Conveyor... 112,753,836 bus.
		Cars..... 4,278,850 "
Rail.....	45,476,412 "	Teams..... 1,618,703 "
		Bags..... 1,288,741 "
	120,107,990 "	
		119,940,130 "
1,052 steamers	1,147 vessels—74,631,578 bus.	
95 barges		
16,649 C.N.	27,631 cars—	45,476,412 "
10,982 C.P.		
		120,107,990
Canadian Grain—	86,403,459 bus.	
American Grain—	33,704,531 "	
	120,107,990 "	
Stock in Elevators—	3,516,577 "	
Transferred by floating elevators—	20,000 bus.	

THE NEW CAR DUMPER

At the opening of navigation in 1923 the Commissioners installed in Elevator "B" at Windmill Point a mechanical car unloader which is the very latest thing in grain elevator equipment, and which was operated during the entire season with such success that provision was made in the plans for



VIEW OF MECHANICAL CAR DUMPER WITH GRAIN CAR
RAISED AND TILTED

the new Elevator No. 3 to have practically all of the unloading of grain from cars carried out at that plant by means of four similar machines. The Car Dumper was designed and installed by the John S. Metcalf Co. Ltd. of Montreal.

The principal point of interest in this car unloading facility is the simplicity and ease with which all operations in

the dumping of the car are attained by the use of cables. Not only is the platform, supporting the car, raised clear of its supports, until it is suspended approximately eight feet above them, then tilted at one end with a corresponding lowering at the other, and the cycle repeated as often as desired, but by the exceedingly simple device of running the two hoisting drums which elevate the rear side of the car a little faster than the two which elevate the front side of the car, a side tilt is obtained without any additional machinery whatever other than a difference in the pitch diameter of the pinion operating the drum on the two sides. In addition to the side tilt, the ram which pushes the grain door into the car is also operated by a cable anchored at one end to the floor of the pit below the dumper, led around a system of sheaves, and finally attached to a swinging arm. As the platform is elevated, the ram is pushed against the grain door with a force of 15 tons, the maximum power possible to apply being regulated by a lever arm in the pit, to which the cable is attached, a weight at the end of the lever arm being 1-70th of the push exerted against the grain door.

The first operation of raising the car eight feet, and at the same time tilting it sideways and pushing in the door, allows of the introducing of several very advantageous points tending materially to simplify the construction and consequently reduce the cost of the machine. In the first place, as the bridge or platform carrying the rails upon which the car sits is elevated eight feet or so above the fixed rail level, it follows that the top of the track hopper into which the grain is dumped may be raised an equal height instead of being, as usual, at rail level, the bottom of this hopper and the belt below it being also raised this height with a corresponding decrease in depth of pit.

The two clamping carriages are interesting in their action. These are operated by a screw shaft extending the entire length of the platform, the shaft being driven by a 10 h.p. motor, located in the centre portion and beneath the platform. As soon as the screw shaft commences to revolve, the two carriages at opposite ends of the platform (each containing

one of the clamps) are drawn towards each other. Shoes on the carriages come in contact with a system of dogs which prevent the further advance of these shoes until the travel of the carriages has caused the clamps to rise. This being accomplished, the shoes are released by the contact of striking pieces on the sides of the travelling carriages, and the clamps and carriages move on as one until the clamp strikes the coupler of the end of the car which is farthest off centre of the platform and drives the car up against the other clamp, thus centering it at the moment the other clamp comes in contact with the other coupler, and by stalling the motor operating the screw shaft, automatically closes the circuit for raising the platform.

The operation of hoisting the platform is entirely distinct from that of tilting it, a separate motor being provided for each.

Four hoist drums are provided, each being situated directly over a suspension sheave on the platform. The pair at either end are driven by a single shaft, both of which shafts are in turn driven by worm gears with a worm on a longitudinal extension of the motor shaft running at 1,200 r.p.m. The pair of tilt drums are operated in a similar way from the tilt motor.

The system of cables is, in effect, an endless one around the hoist and tilt drums; when the hoist drums are operating, the tilt drums are anchored and vice versa. The counterweights act directly upon the hoist and tilt drums, and are of sufficient magnitude to necessitate the platform and empty car being wound down by the hoist drums, thus equalizing the load on the motors and avoiding any heavy peak load.

The electrical control is so wired as to make it impossible to perform the required operations out of sequence, i.e., it is not possible to raise the platform until the clamp motor has stalled, or to tilt the platform until it has been raised to the desired height.

The machine is designed to handle a car of a maximum weight of 50,000 pounds, containing 135,000 pounds of grain.

The minimum speed of operation required was six cars

per hour, and at the first time trial made, seven cars were unloaded in that period. During the season of 1923, seventy cars of wheat and rye have been unloaded in ten hours. It is estimated that the economy effected in time and labour by this car unloading device is around 80 cents per car.

EXPLOSIONS IN GRAIN ELEVATORS

Their Cause, Effect and Prevention

One of the most interesting subjects of discussion at the Annual Convention in New Orleans of the American Association of Port Authorities was a paper presented by Mr. D. J. Price, Engineer in Charge of Development Work, Bureau of Chemistry, U.S. Department of Agriculture, in regard to the causes of, and suggested methods of prevention of grain dust explosions in elevators.

The more noteworthy points touched on by Mr. Price follow:—

“Dust explosions can occur from the time the grain is harvested in the field until the finished product is manufactured in the industrial plant. Going a step further, we find that dust explosions have occurred in country elevators during the handling of grain and during shipment to terminal markets. Although the explosions in country elevators have been less frequent, probably on account of the small scale of operation, investigations indicate that these plants are subject to dust explosions and that control methods should be adopted. When we reach the large terminal elevators, however, we find that the hazard is greatly increased. Some of the most disastrous explosions on record have occurred in modern grain elevators in the terminal markets. The explosions which occur from the time of threshing until the time of handling and storing grain in the terminal market are due entirely to the ignition of dust produced during the handling of the grain. This has been an interesting development, because it has not been many years since the grain industry felt that it was necessary to

crush or grind the grain, thus releasing the starchy material contained therein, before it was possible for a dust explosion to occur.

"The immediate field of effort in industrial plant dust explosion prevention lies in the development of preventive methods for dust explosion control in grain elevators. The large scale of operation, size of plants, large quantity of dust produced during handling, elevating and storing of grain and the introduction of new ignition sources make necessary thorough investigations of this particular phase of dust explosion control.

"A number of definite causes of dust explosions in industrial plants have been clearly established, but reference will be made only to those that have been most prominent in connection with recent explosions in grain elevators."

Matches and Smoking

"It is no longer necessary to debate the possibility of igniting a dust cloud by a match struck by a workman. It has been proved in many instances in which dust explosions have occurred in various types of industrial plants. Explosions have been caused when employees struck matches to determine the amount of product in a bin or enclosure, thereby igniting the dust cloud in suspension."

Open Flames and Naked Lights

"In the class of open flames may be included lamps, torches of various kinds, lanterns, gas lights, and candles. A large number of explosions and fires have been caused by the introduction or use of open flames and naked lights in dusty atmospheres. All types of open flames will ignite inflammable dust under favourable conditions. This includes not only flames which are entirely unprotected, as an ordinary fishtail gas flame or the flame of a match, but also protected lanterns or enclosed Welsbach lights. Consequently, all protected and unprotected flames must be kept out of elevators where there is inflammable dust, if explosions are to be prevented."

Small Scale Fires

"In many cases explosions have followed small fires in industrial plants. If a fire is started in a plant where considerable dust is present and the dust is thrown onto the flames of the fire, an explosion follows. A large number of explosions caused in this manner have resulted in extensive property damage, in some cases in loss of life. Some explosions have occurred while firemen have been fighting the fire, supposedly due to stirring up a dust cloud by a stream of water. Care should therefore be taken in fighting a fire where inflammable dust is known to be present not to stir up the dust any more than is necessary. If it is possible to determine the location of large accumulations of dust, these should be wet down, directing the stream of water over and not towards them."

Electrical Causes

"Electrical causes of dust explosions may be divided into two classes: (a) Electric sparks from motors, switches, fuses, short circuits, etc., and (b) the breaking of electric lamps, or fires caused by dust settling on the lamp globes. For a time there seemed some doubt as to whether an electric spark would ignite dust. It is now known, however, that a much smaller spark than was thought possible will ignite certain dusts. The most disastrous dust explosion which ever occurred in an industrial plant in England was attributed to the blowing of an uncovered fuse on a temporary switchboard at the very moment when a large belt broke and stirred up a dense cloud of dust which had been allowed to accumulate in that portion of the plant. Thirty-one men lost their lives, and 101 were injured.

"The series of tests conducted by the U.S. Department of Agriculture in co-operation with lamp manufacturing companies shows that explosions can be produced by the breaking of an incandescent lamp bulb in dusty atmospheres. It has also been found that under certain conditions a fire may result

from the ignition of dust which accumulates on the globes of incandescent lamps. To guard against this danger, and also the explosion hazard, all incandescent lamps in dusty atmospheres should be enclosed in vapor-proof globes and well guarded.

"We should have no difficulty in understanding what a dust explosion really is and the circumstances under which it may occur. For some years dust explosions were surrounded by a shroud of mystery and we did not clearly understand the matter. We seem to have no difficulty in understanding that gas, when mixed with air in proper proportions, forms an explosive mixture and that if it is ignited an explosion will follow. As soon as we recognize the fact that finely divided combustible dusts and air, when mixed in proper proportions, produce an explosive mixture, we readily understand why dust explosions occur.

"In order that dust explosions may occur, two conditions are necessary:—(1) There must be a proper mixture of dust and air in suspension, which must be of explosive proportions, and (2) this mixture must be ignited by some external source of heat or fire equal to the ignition temperature of the dust. It is now generally accepted that dust explosions cannot occur spontaneously. This must not be interpreted as meaning that there is no such phenomenon as 'spontaneous combustion,' which is quite a different thing from 'spontaneous explosion.' It is just as impossible to produce a 'spontaneous dust explosion' as it would be to produce a 'spontaneous gas explosion.' The explosive mixture of dust or gas must be ignited. The dusts from any material which burns will explode under favourable conditions. The ease of ignition, of course, depends on certain factors, such as composition and fineness of the material and the quantity of moisture in the dust. As a rule, if the dust is sufficiently fine and dry enough to form a cloud or to be thrown into suspension in the air, it will be ignited, producing an explosion.

"In order to effectively prevent dust explosions and fires, it is essential that not only all possible sources of ignition be eliminated, but also that the plant be kept clean, thus removing

the medium through which the primary explosion may spread into the secondary and more violent explosion."

Some Methods of Control and Prevention

"Plant Cleanliness—It would seem almost unnecessary to refer to the great importance of effective methods for dust removal and plant cleanliness. The extent of dust explosions, however, has been very closely related to the quantity of dust that has accumulated throughout the elevator at the time of the primary ignition. Before an explosion or fire can take place, something to explode or burn must be present, and enough dust to allow the flames to spread must be in suspension in the air.

"The most disastrous dust explosions in industrial plants have occurred in industries where the dust is permitted to accumulate on ledges, beams, girders, and similar places throughout the plant. In industries where the dust has been effectively controlled and good housekeeping practised, the extent of the explosion has been localized. It is gratifying to observe that progress is being made in developing pneumatic sweeping systems for the removal of static or settled dust in industrial plants and grain elevators. It is anticipated that systems of this kind will be sufficiently improved and developed to replace the old-time 'push broom' practice and reduce the possibility of flame propagation as a result of static dust deposits throughout the plant. Engineers in charge of industrial operations will find it advantageous to become acquainted with the advance made in this field and determine the practical value of installing equipment of this character for dust explosion prevention.

"Plant Construction—The construction of the plant has a very close relation to the explosion possibilities. It should not be of the type that will permit dangerous accumulations of dust. Attention to dust explosion prevention should be given by construction engineers in designing grain elevators. Practical use should be made of the material

which has been collected in the investigation of these explosions, where the extent and violence of the explosion was closely associated with the type of construction.

"No matter how well the plant is constructed, it must be well kept. It has been well proved that a plant built of fire resistive materials, in which the dust condition has been neglected and no attention given to the problem is a much greater explosion hazard than an elevator built of combustible materials, but well cared for and maintained at a high standard. We must, of course, continue to embody the best principles of construction, but in addition, we must adopt effective means for proper upkeep and maintenance. We cannot expect to control these explosions, unless we first control the material which is explosive and without which the explosion would not be possible.

"All electric lamps located in dusty atmospheres should be enclosed in vapor-proof globes and properly guarded. All possible precautions should be taken to prevent or control choke-ups in elevator legs.

"Dust collecting systems should be arranged so that the collecting units, and preferably also the fans and ducts, are outside of the elevator building. Often entire batteries of dust collectors are located inside the building or between two units of the plant, and the large quantities of dust in suspension within the collectors constitutes, within the plant, an explosion hazard which could have been removed by a different arrangement of equipment.

"Ventilation is essential, and arrangement should be made to provide it in all parts of the plant. Windows, curtain doors and roof vents will probably be sufficient for upper floors of the work-house, and possibly for the working floor, but if the building is closed in on two or more sides, disc fans installed in the walls may be necessary. Ventilation of basements may be accomplished by the use of disc fans or a central flue or chimney formed by an interstice bin open at the bottom and extending above the roof. A fan can be installed to produce either a forced or an induced draught up this flue."

Dust Control and Removal in Grain Elevators

"It is quite evident from a thorough study of the problem that the dust condition in so far as grain elevators are concerned really resolves itself into two distinct phases. First, the creation of dust at all points in the elevator where grain is thrown or handled, and, second, the escape and settling of this dust on beams, ledges, girders and similar points throughout the plant. This dust settling throughout the elevator forms an accumulation of static dust and has been a contributing factor in practically all of the recent explosions in grain elevators. We can fully realize the importance of the removal of this accumulated dust when we consider that dust explosions, as a rule, occur in two stages, (1) the primary, and (2) the secondary explosion. The original or primary ignition is usually accompanied by sufficient concussion to shake the accumulated dust into the air and feed the flame of the first explosion and permit it to propagate throughout the entire plant. This propagation of flame is very rapid, and is accompanied by excessive pressures, reaching the stage which we term explosion.

"The matter of controlling dust at the points of creation in the elevator is a timely one at present. If we recognize that these grain dusts are explosive, it would seem to indicate that provision should be made to prevent the escape of dust during the handling, elevating and storing of grain. The best control has been secured in representative lines of industries by the application of mechanical equipment for the collection of explosive dusts at the points where created, which prevents the dust from escaping and settling throughout the plant, and requiring later removal. We are of the opinion that we cannot expect to advance in our working out of control measures until we endeavour to handle in some way by mechanical means this explosive dust at points where created. Our present method of operation in practically all of our grain elevators on this Continent permits the escape and accumulation of dust and presents an ever-present menace, simply waiting for the ignition of a small quantity of dust to throw

into suspension additional dust clouds which will bring about an explosion resulting in loss of life and property."

Mr. M. P. Fennell, Jr., General Manager of the Port of Montreal, who as President of the Association occupied the Chair at the Convention, took part in the discussion which ensued on Mr. Price's paper, and drew the attention of the meeting to the steps which the Harbour Commissioners of Montreal are taking to prevent explosions in their grain elevators, pointing out that in the three existing grain elevators of the Commission, vents or openings have been cut in the roofs over the tops of the lofter legs, so that if an explosion takes place where the majority of explosions occur, namely, in the legs, the force of the explosion will not be taken through the house, but will be dissipated to the elements. In regard to the Commissioners' new Elevator No. 3, Mr. Fennell stated that it followed an entirely new idea in grain elevator construction, the working house being in the centre of two storage units, and being without covering of any kind, so that should an explosion occur, there will be no concrete or masonry to resist its pressure. In addition, this new elevator will be fitted with a mechanical window-opening device, which will cause all the windows to swing open whenever pressure, such as would be caused by an explosion, occurs inside the building.

COLD STORAGE WAREHOUSE

The new Warehouse, completed in the summer of 1922, has had its first full year of operation. The demands placed upon it have been highly gratifying, particularly with respect to the cold storage division. At the beginning of the year 1923, the cold storage space was about 50% filled. Gradually throughout the year there was an increase in volume stored, until during the months of October and November more stocks were offered for care and refrigeration than there was ability for the space available to handle.

It becomes more and more apparent that the producers and dealers in perishable products, particularly apples, butter, cheese, eggs and poultry, are finding it to their advantage to



WAREHOUSE AND COLD STORAGE PLANT

store their products at the largest centralized market in Canada, because of the better ability to find satisfactory markets either in domestic consumption or in export. The impetus to production lies almost entirely within the field of marketing and distributing abilities. The market movements of perishable products are very rapid, and few purchases are made without the privilege of personal inspection by the buyer at the time of delivery. This being the case, the producers and dealers are finding it to their advantage to have their goods stored at the centralized market where the buyers can more readily make their inspections and their tenders on the basis of the valuation established by these inspections.

The Dominion of Canada is a country of long distances between producers and consumers. The Western Provinces, in their agricultural development, are rapidly going to diversified farming and away from the one-crop commodity. The increase in production of butter, poultry and eggs in the Western Provinces is very rapid. Government reports and reports from the officials of the Provinces show this, and it is believed that these increases have only started. Last year very considerable amounts of these commodities came to this warehouse for storage from these Provinces, the stocks passing into both domestic consumption and to satisfy export demand.

There is tabulated herewith a comparative statement of the more important products stored here, which will be of interest:—

	1923		1922
Apples.....	43,970	brls.	30,000 brls.
Butter.....	2,957,864	lbs.	1,672,000 lbs.
Cheese.....	26,235,450	"	13,250,000 "
Eggs.....	1,806,450	doz.	1,200,000 doz.
Frozen and Pickled Fish...	1,222,229	lbs.	850,000 lbs.
Meat.....	4,633,065	"	1,500,000 "
Poultry.....	839,807	"	500,000 "

Aside from these commodities, there was received and passed through the warehouse large quantities of miscellaneous stocks, such as hops, ferns, nuts, figs, dates, dried apples, onions, celery, turnips, carrots, and stocks of like nature.

It will be noted that, in the comparative figures, there are shown to be increases in each of the classifications indicated. It is believed that quite largely this is due to the desire to have the goods stored at the point of export or at the centralized market as described heretofore. To some extent the longshoremen's strike in England affected conditions here,



A FEW OF THE PRODUCTS HANDLED IN THE COLD STORAGE WAREHOUSE

and it was of decided importance to the shippers in the Dominion of Canada that facilities were here to protect the goods during the period when deliveries to the Ports of Great Britain were impossible due to the labour troubles.

During the year packing house products were placed in our care. Some of these products came to the warehouse for care because of the shipments being delayed and missing the

steamers, or because of the steamers changing schedules. This feature will undoubtedly assume greater proportions for the reason that the highly perishable products of the packing houses must not be delayed in transportation during the excessively warm weather, excepting under the care of proper refrigeration conditions. The position of the warehouse in this Harbour adds an insurance to the protection of the goods exported through this Port that is finding serious consideration on the part of both the Canadian and American meat packers, and while the volume of packing house products passing through this Port has been large, it will undoubtedly increase because of this safety factor as the purchasing power of the European consumer is increased.

The fur dealers in Montreal, which is one of the largest fur markets on the North American Continent, because of the inadequacy of cold storage facilities, have been accustomed to storing their furs during the Summer periods in ordinary storage, using an insecticide for the protection of the furs. They realize that the lustre is depreciated by this condition, and at one time last year there was in storage in this warehouse upwards of one million dollars' worth of furs. This was during the extreme warm weather, and the fur people felt that their product was benefited by being held in cold dry air. This is the universal experience with furs, and we may expect to have larger demands made on us for the handling of this valuable commodity.

Large quantities of hops were offered to us throughout the year. This product is used in the manufacture of ales and beers and the producing of yeast. The storage of hops in a low temperature is for the purpose of holding the volatile oils in suspension in the leaves, because it is in these oils that the flavour of the hops is held. Practically all of the hops that are used are imported from great distances, and therefore it is necessary for the manufacturer in Montreal to carry considerable stocks.

While there has been an increase in the demand for ordinary storage space, that increase has not been in the same ratio as that in the cold storage division. During the early Spring

and late Fall, the cheese that has arrived here has been generally stored in the ordinary storage on the demand of the owners of the stock, because of the lesser rate that is charged in ordinary storage than is charged for cold storage. This took up practically all of one floor during the periods that it was possible to store cheese in ordinary storage. As soon as the warm weather came, all cheese was stored in cold storage.



WESTERN BEEF IN STORAGE

There was an increase in the stocks of tea, coffee and canned goods, viz., canned soups, canned vegetables and canned fruits, stored in ordinary storage. These stocks reached a considerable proportion in volume, and the building being so dry and fireproof, the owners found the conditions very acceptable to them.

Considerable amounts of binder twines were stored for the Co-operative Farmers' Associations, and distributed to the individual farmers from here. Practically all of this binder

twine is imported by the Farmers' Associations, and it seems a fitting service to be performed by this warehouse for the Farmers' Associations.

Aside from the above-named products, quantities of sugar, cotton, dry goods, etc., were handled.

On the whole, the growth of the demand throughout the year has been beyond expectations. The warehouse is becoming a factor as a marketing and distribution agent for the producer of Canada. It will undoubtedly become a great factor in the marketing phase, and therefore be of greater assistance to the producer and to the consumer alike.

HARBOUR RAILWAY TERMINALS

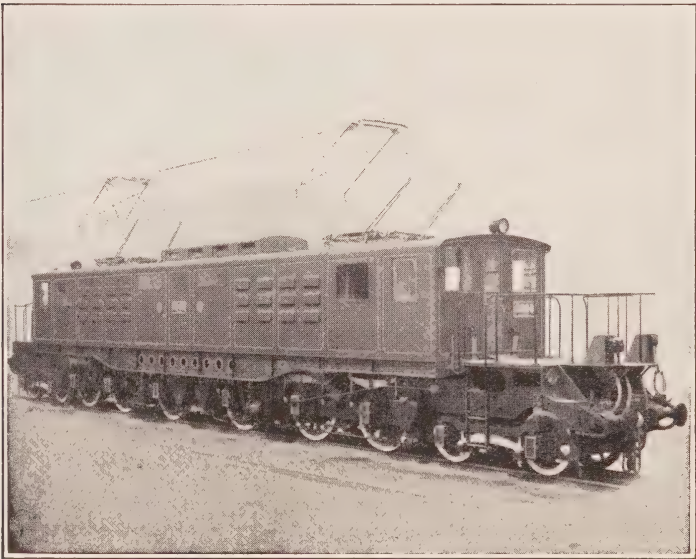
Railway traffic operations during the closed season of the year 1923, January to April and during the month of December, showed an appreciable improvement in comparison with the same period last year. Limited only to the usual sources of winter traffic, the returns nevertheless increased by more than 40% as compared with 1922.

The season of navigation, although somewhat delayed by weather conditions in getting under way, furnished, for the first three months, returns of a very satisfactory volume. The operations during the month of June, in fact, exceeded in a great measure those of the same month in any other year, being surpassed on one occasion only, in October, 1922. Beginning with the month of August, however, the movement of rail traffic diminished considerably, so much so that by the end of the season of navigation more than half of the increase in car handling had been wiped out. The explanation of this is easily found when it is noted that the movement of grain in cars for Elevators Nos. 1 and 2 during the year decreased by 12,618 cars, compared with last year. Apart from this decrease in this particular commodity, the movement of other rail-hauled traffic kept well ahead of last year.

The increase of 4,226 cars loaded and unloaded at the Harbour sheds shows that the ordinary import and export traffic furnished their quota of the year's increase. In the

export business a new source of traffic was developed during the year by the handling of refrigerated products in cars from the Commissioners' Cold Storage Warehouse to the various Harbour sheds for shipment abroad.

Local traffic to and from the different sections of the Harbour terminals and to and from the various industries adjoining the Harbour was carried out in a very satisfactory volume. Particularly so was the movement of traffic from the extreme eastern terminus, where, notwithstanding the falling off in the imports of coal from Continental Ports which last year had attained imposing figures, the car handling increased this year by nearly 30%. Standing out pre-eminently as the main feature in the year's increase in operations is the increase of 11,287 cars, or 70%, in the movement of interchange traffic. Large as this may appear, it is quite within reason to believe that this source of traffic is still susceptible of further expansion, and it might not be amiss here to suggest that as a connecting link between the terminals of the Canadian National



ONE OF THE NEW HARBOUR RAILWAY ELECTRIC FREIGHT LOCOMOTIVES

Railways in the western part of the city and those of the Canadian Pacific Railway the harbour terminals be made use of.

By avoiding the long and circuitous route now in use, sufficient inducement in the matter of freight rate reduction and despatch to shipments should be offered to incite shippers to efforts to have these terminals recognized as a regular interchange point between the two Railway Companies.

The movement of rail freight strictly within the limits of these Harbour terminals which developed during the last few years in the handling of coal, grain, sugar and cement was maintained throughout the year on a scale equal to last year.

For the greater part of the season of navigation electric motive power was made use of on these terminals as a complement to the steam power, and while, owing to the restricted conditions under which the new motive power was operated, it would be premature to express any decided opinion of its advantages or disadvantages, it may be safely stated that in such services as we were able to employ the electric locomotives very satisfactory results were obtained.

No new track work of any importance was undertaken during the year. A new eastern connection between the Harbour tracks and those on Commissioners' Street was laid down and found useful in facilitating certain switching operations. The extensive rearrangement of tracks consequent upon the construction of Elevator No. 3 made for more difficult and expensive operations of traffic on that part of these terminals.

Summing up the foregoing, with a total handling of 216,382 cars—a figure reached previously in 1917 and 1918 only—and with a total revenue in excess of any other year in our history, the year 1923 was very satisfactory.

The following table gives the mileage of Harbour Railway tracks and the number of cars handled during the last fourteen years:—

	Mileage of Harbour Railway Tracks	Number of Cars handled by Commissioners
1910.....	28.86	79,466
1911.....	28.97	93,859
1912.....	34.91	112,911
1913.....	37.30	114,531
1914.....	39.88	114,499
1915.....	44.92	157,480
1916.....	49.11	234,439
1917.....	52.35	215,394
1918.....	55.35	247,009
1919.....	58.32	182,328
1920.....	58.34	174,181
1921.....	58.54	143,564
1922.....	58.77	200,593
1923.....	60.64	216,382

The extent of the Harbour Commissioners' Railway tracks at the end of 1923 is as follows:—

	lin. ft.	or miles
South of Lachine Canal, Bickerdike Pier, Windmill Point Wharf and West....	38,503	7.2922
To Guard Pier.....	10,400	1.9697
Sections 12 to 46, High Level, Main Line Tracks.....	51,170	9.6913
To Piers, Elevators, Crossovers and Sidings, etc.....	109,821	20.7994
Sections 35 to 46, Low Level, Main Line Tracks.....	10,080	1.9090
Sections 46 to 101, High Level, Main Line Tracks.....	54,134	10.2526
To Wharves, Industries, etc.....	43,792	8.2939
At South Shore, St. Lambert.....	2,300	0.4356
Grand Total Tracks end 1923.....	320,200	60.6437
Grand Total Tracks end 1922.....	310,349	58.7781
Increase in 1923.....	9,851	1.8656

POLICE DEPARTMENT

During the summer season the Harbour Police Force, consisting of one chief, three captains, and forty-seven constables, regulated the traffic on the wharves, maintained order, and protected life and property within the Harbour.

For the winter season, the force consists of four officers, twenty constables, and one fireman.



· SOME OF THE HARBOUR POLICE FORCE

During the season 121 passenger ships docked, carrying 31,285 passengers from British and European Ports, and the same number of ships sailed with 32,327 passengers. Passengers arriving at the Canada Steamship Lines wharf, Victoria Pier, from lake and river steamers numbered 65,969, and 27,856 passengers sailed from Victoria Pier bound for points up and down the river, making a grand total of 157,437 passengers arriving and departing at the Port during the season.

During the year the Chief of Police or a captain was in attendance with the paymaster on all pay-days, and escorted him to the bank and on his rounds without mishap. Armed constables were also stationed on the streets between the bank and the Harbour office. Armed Harbour constables were also hired by various shipping companies to protect their paymasters on their respective pay-days.

The Harbour police constables saved nine persons from drowning with the assistance of life belts and poles distributed along the Harbour front.

During the year 112 arrests were made on the wharves.

17,527 carters, loading at various places on the wharf, were checked and regulated by the traffic constables.

18,857 taxicabs and cabs carrying passengers to and from vessels were regulated coming on and leaving the wharves during the season.

During the season no accidents occurred at or near the gates and railway crossings where constables are on traffic duty or on any of the Harbour roads.

ACCOMMODATION

The total cost of the Port of Montreal has been thirty-nine and a half million dollars, and this is represented by:—

Deep draught berths capable of accommodating over 100 modern large ocean steamships simultaneously.

Thirty-five of these steamship berths are at modern concrete wharves, built in the past few years.

Three large modern fireproof elevators, with conveyor system to 26 steamship berths, at which 19 vessels can be loaded with grain at one time.

Twenty-four permanent fireproof transit sheds.

Modern cold storage warehouse.

Sixty miles of Harbour Railway tracks.

Complete and valuable construction and repair plants.

About 200 acres of land situated in the most valuable position, industrially, in Montreal, all reclaimed.

At what other Port in the world could such valuable accommodation be shown, created at such low cost ?

The extent of the wharves and piers at the end of the season is as follows:—

30 ft. depth and over at O.L.W. . . . 28,503 lin. ft. or 5.3983 miles
 25 ft. to 30 ft. depth 15,312 lin. ft. or 2.9000 miles

Total deep draught 43,815 lin. ft. or 8.2983 miles
 20 ft. depth and under 1,398 lin. ft. or 0.2647 mile

Total wharfage end 1923 . . . 45,213 lin. ft. or 8.5630 miles

HARBOUR BOUNDARIES

Negotiations were completed for the adjustment of the boundary between the properties of La Fabrique St. François d'Assise de la Longue Pointe and adjoining proprietors, and the Harbour Commissioners; and also the Boundary Line between the properties of the Canadian Spool Cotton Co. and the Harbour Commissioners, East of Pius IX Avenue.

In both cases the adjustment will be to the mutual advantage of all parties, and, in the case of the Harbour Commissioners, will provide a better alignment and more clearance for the railway tracks adjoining.

VICKERS DRY DOCK

Forming an important and integral part of the facilities of the Harbour, the dry dock and shipbuilding and repair plant of Canadian Vickers Ltd. at Maisonneuve continues to serve satisfactorily the requirements of the shipping using the Port of Montreal. During the season of navigation of 1923, 72 vessels were repaired in the "Duke of Connaught" Floating Dock in the following monthly proportions:—May, 10 ships; June, 7 ships; July, 14 ships; August, 10 ships; September, 7 ships; October, 4 ships; November, 11 ships; December, 9 ships. In addition, numerous repairs of a minor nature were carried out to ships afloat, both in the Maisonneuve Basin and at the other berths in the Harbour, in all 146 vessels being attended to in this manner.



AIRPLANE VIEW OF CANADIAN VICKERS DRY-DOCK AND SHIP
REPAIR PLANT

Canadian Vickers Ltd., while continuing to keep their ship repairing facilities up to a high standard, have been compelled by the depression in the shipbuilding industry to make a radical departure from their previous line of business, and have remodelled their shipbuilding works. The plant and organization which was used so satisfactorily during the war in building ships and submarines has now been converted into a shop for the manufacture of structural steel and industrial machinery of all kinds. On entering the structural steel field, Canadian Vickers assumed control of the Phoenix Bridge Co., and with the amalgamated forces obtained various steel erection contracts, amongst these being that for the steel work of the Commissioners' new Elevator No. 3 at Tarte Pier.

This Company has also undertaken the construction of air machines, and during 1923 completed their first contract by building eight Vickers "Viking" flying boats for the Department of Defence, Ottawa.

NEW WORKS AUTHORIZED DURING 1923

As detailed in the Annual Report for 1922, new works amounting to \$2,272,544.65 were authorized in that year out of the \$5,000,000 granted to the Commissioners by Act 12-13, Geo. V., chap. 33.

By Act 13-14, Geo. V., a further loan of \$10,000,000 to the Commissioners was authorized, "to enable the Corporation to carry on the construction of terminal facilities in the Harbour of Montreal, for which plans, specifications and estimates were approved by the Governor-in-Council before the passing of this Act; and to construct such additional terminal facilities as are necessary to properly equip the said Port." There was accordingly a balance of \$12,727,455.35 available for expenditure on capital account, and during 1923 Orders-in-Council were issued authorizing the Commissioners to proceed with the construction of the following:—

Grain Elevator No. 3 and Conveyor System.....	\$2,347,000.00	
Work in connection with the new Grain Elevator No. 3:		
(a) Marine Tower Jetty:		
For constructing a jetty in connection with the new grain elevator, in the basin between Tarte and Laurier Piers:		
To cost.....	\$506,667.00	
(b) Embankment for tracks to new elevator.....	58,850.00	
(c) Diversion of Nicolet St. sewer.....	15,000.00	
	<hr/>	580,517.00
Two new transit sheds, Sections 26-30:		
Two single storey, steel and concrete fire-proof transit sheds on the newly finished high-level quay walls at these sections.		
To cost.....		281,187.50
Harbour Railway, Victoria Pier to Queen City Wharf: For providing a railway yard for the new elevator and for storage tracks east of this yard; for new tracks		

on Shore Wharf at Sections 27-30; for extending Pius IX St. subway and Aylwin St. subway and ramp.....	332,839.89
Paving and track extensions:	
Paving at new Elevator No. 3; paving at new sheds, Sections 26-27, including double ramp at Papineau Avenue; paving at Sheds 24-25; paving Bickerdike Pier; new tracks on Bickerdike Pier.	
To cost.....	214,482.09
Bickerdike Pier approach dredging:	
A further stage in dredging the channel approach to Bickerdike Pier.	
Estimated cost.....	500,000.00
Sawmill and timber storage shed, Bickerdike Pier: For the construction of a concrete timber and storage shed, to be leased by the British Empire Lumber Corporation, upon terms already agreed upon.	
To cost.....	175,000.00
Water Mains and Drains:	
For new services. Estimated cost.....	50,000.00
Extension of Harbour Railway Electrification:	
For completing the electrification of the entire Harbour Railway system by putting under electric operation the railway in the western section of the Harbour from Victoria Pier to McGill Street, including the main tracks and sidings of the three piers, Jacques Cartier, King Edward and Alexandra; also the electrification of the sidings and intersections outside the Flood Wall on Commissioners' Street; the railway extensions necessitated by new works under progress and including the new railway yard for Elevator No. 3 and storage sidings; also additional tracks between the Dominion Coal Wharf and the Dry Dock, and the necessary railway connections to serve new transit sheds Nos. 26 and 27. The total length of track to be put under electric operation is approximately 20 miles, at a total estimated cost of.....	887,000.00

General Improvements and Plant:

Electric equipment for Machine Shops, Mackay Pier and Notre Dame St. E.	\$37,000.00	
Extension of Harbour Lighting Circuits.....	26,000.00	
Extension to existing Machine Shops at Harbour Yard, Notre Dame St. E., including an extension to the building, and additional heating equipment and machinery.....	148,500.00	
		211,500.00
New Track Work, McGill Street to Victoria Pier:		
For relaying the two main line tracks from McGill Street to Victoria Pier with 100 lb. rails, as well as the curves on connecting tracks which run along the King Edward, Alexandra and Jacques Cartier Piers, and the placing of the necessary special work such as diamonds, crossovers, turnouts, etc., removing and replacing pavement, as necessary, and laying the necessary drains, manholes and gratings.....		241,060.00
Six wooden deck scows for dredging work:		
Estimated cost.....		102,610.00
Insulation of the eastern halves of the second and third floors of the Cold Storage Warehouse, originally constructed for dry storage, but now found necessary for equipment for cold storage.....		150,000.00
Expenditure in suspense from previous years:		
Warehouse and Cold Storage Plant.....	\$1,391,274.20	
Victoria Pier Sheds Nos. 17, 18 and 19.....	402,527.67	
Conveyors and Marine Tower Jetty, Elevator No. 2	72,625.35	
Electric Freight Hoists for Sheds 16 and 17, Sheds 18 and 19 and Sheds 24 and 25.	64,800.00	
Electric Lighting System for Wharves.....	30,000.00	
		1,961,227.22
Total.....		\$8,034,423.70

ENGINEERING DEPARTMENT

New Works

The main feature of last year's programme of new works was the vigorous resumption of wharf construction, more or less in abeyance during the previous six years, and the breaking of all previous records in that class of work.

The notable feature of this year's programme, the greatest by far ever undertaken by the Harbour Commissioners as regards capital expenditure, has been the great expansion of the Grain Elevator and Conveyor System, by increasing the facilities at Elevator "B" and the establishment of a new Elevator, No. 3, and Grain Conveyor System at the Tarte Pier, Maisonneuve.

The development at the Tarte Pier is not only the more important of these two items, but it is perhaps the most



CONSTRUCTION PHOTOGRAPH OF NO. 3 ELEVATOR

interesting undertaken by the Commissioners for many years, as the work under construction is only the first unit of a large scheme of development which will eventually transform the Maisonneuve section of the Harbour into a very improved replica of the present Central Harbour.

The construction of the new elevator and conveyor galleries has necessitated many other subsidiary works of considerable magnitude, including the building of a marine tower jetty, retaining walls and subway extensions, the formation of a new railway yard and the remodelling of the railway system in that section.

The following are the principal items of construction undertaken during the year:—

Construction of Elevator No. 3 and five new grain loading berths at the Tarte Pier.

Extension of Elevator "B" and four additional grain berths at Windmill Point.

Completion of extension to Alexandra Pier.

Completion of extension to King Edward Pier.

Extension of Shore Wharf, Section 30.

Construction of marine tower jetty at new Elevator No. 3.

Extension of Bulkhead Wharf in front of new Elevator No. 3.

Completion of extension to Imperial Oil Wharf at Mont-real East.

Completion of sawmill and timber storage shed, and erection of transformer house on Bickerdike Pier.

Erection of new transit sheds Nos. 26 and 27.

Erection of new wharf office building at Victoria Pier.

Erection of new machine shops and installation of equipment and machinery in same, at Harbour Yard, Notre Dame Street East.

Dredging approach channel for Bickerdike Pier Extension.

The laying of additional sidings on the Bickerdike Pier and vicinity for the use of the Canadian National Rys., Canadian Import Co. and British Empire Lumber Corporation.

Improvement of track layout at west end of Elevator No. 2.

Enlargement of flood gate opposite east end of Elevator No. 2 and railway connection made between tracks outside of flood wall and Harbour main lines.

Extension of tracks to serve new shore wharf at Sections 27 and 29.

Improving existing tracks and laying additional sidings at Dominion Coal Wharf, Section 37.

The removal of original low level tracks and the formation of a railway ramp and railway yard for Elevator No. 3.

A railway siding for the Dominion Tar and Chemical Co. at Section 62.

A spur for the Hospice St. Benoit at Section 79.

Completion of double diamond railway crossing and consequent rearrangement of intersections at Canada Cement Company's wharf at Montreal East.

Construction of retaining wall forming south side of ramp at Papineau Avenue Subway.

Extension of Aylwin Street Subway and construction of east-and-west wing retaining walls to form north side of future ramps.

Diversion of Nicolet Street sewer.

Formation of new paved roadway from the north end of Bickerdike Pier to Mill Street.

Paving of roadway behind Sheds 24 and 25 and leading to eastern entrance of the Cold Storage Warehouse.

The installation of a 20-ton auto truck scale on Victoria Pier.

The extension of the water main on Bickerdike Pier and at Sections 26 and 27.

Widening of the main channel in the Central Harbour.

Completion of electrification of the eastern section of the railway system and the commencement of electrification of the western section.

Extension of power transmission lines from the power house at Section 23, around Windmill Point Basin to the north end of Bickerdike Pier, serving Elevator "B" and the coal and timber plants, and also from the Harbour Yard to new Elevator No. 3.

Extension of Harbour lighting system at Windmill Point Basin, Bickerdike Pier and Victoria Pier.

New transformer house at Elevator "B."

Commencement of relaying of main lines and spurs to piers from McGill Street to Victoria Pier with 101 lb. rails, preparatory to electrification.

The general maintenance of berths, channels, wharves, railways, roadways, sewers, water service, scavenging, lighting, hoists, bridges, subways, flood gates, etc., was carried on as usual.

New Wharves

Extension of Alexandra Pier.

This work, fully described in the previous Annual Report, was begun in September of last year, and at the beginning of this season only 3,350 c. yds. of mass concrete was required to complete the superstructure.

The structural work was fully completed by the contractors, the Atlas Construction Co., and handed over to the Commissioners on 1st October.

The filling of the core is in progress.

Extension of King Edward Pier.

Similarly, this work was begun in October of last year and the substructure completed, but at the beginning of this season the greater part of the concrete superstructure had yet to be done.

The structural work was completed by the contractors, the Atlas Construction Co., and handed over to the Commissioners on 25th October, some 6,252 c. yds. of mass concrete having been required to complete the work. The filling of the core is in progress.

High Level Shore Wharf, Sections 27-30.

The filling of the bulkhead area behind the 1,637 ft. extension of this wharf, completed last year, progressed rapidly, and

this section was in full operation during the whole season of navigation, being utilized almost exclusively for the unloading of coal. So great were the demands for wharf space and so quickly was last year's extension fully taken up that it was decided to make a further extension of this wharf, and on 5th July a contract was awarded to the Atlas Construction Co. to construct an additional length of approximately 700 ft.

In carrying out this work a departure was made from the previous design of a straight line wharf and the new extension was constructed in the form of a saw tooth, forming part of the amended design for the remainder of this wharf.

The berths so formed will be 500 ft. in length with a bulkhead in front of each berth of 75 ft.

The advantages of this design are:—

1. That a ship lying at her berth will be protected to some extent from the current by the bulkhead in front.



HIGH LEVEL WHARVES UNDER CONSTRUCTION

2. That ships moving in and out of their berths will do so much more freely and without any disturbance to vessels lying at adjoining berths; and

3. Each berth being offset 75 ft. will give more space on the wharf area, which, at this particular section, is rather narrow, and a much better layout will be obtainable with regard to transit sheds and the railways serving them.

Notwithstanding some difficulty in obtaining adequate deliveries of timber, the work made good progress, and by the end of the season the entire cribwork substructure, embracing five cribs of a total volume of 742,396 c. ft., was completed, while the concrete superstructure was more than half done, about 2,645 c. yds. of mass concrete having been put in place.

Marine Tower Jetty at New Elevator No. 3.

One of the important subsidiary works in connection with the building of new Elevator No. 3 was the construction of a marine tower jetty, located approximately in the centre of the basin between the Laurier and Tarte Piers and running from the bulkhead wharf, parallel with the piers.

On this jetty will operate the four travelling marine towers which will unload from lake vessels into the elevator.

The entire substructure of the jetty consisted of one huge crib, varying in length from 286' 8" to 367' 1", 77' 3" in width and 43' 9" deep, the total volume being approximately 1,080,000 c. ft., and although work was much impeded by late deliveries of timber, this crib, by far the largest ever constructed in the Harbour of Montreal, and probably the largest ever constructed, was completed and successfully sunk during the first week of November.

Before the close of navigation, approximately one-quarter of the concrete superstructure was completed, some 2,000 yards of concrete having been put in place.

The structural work was done under contract by the Atlas Construction Co., the dredging, sinking and filling being carried out departmentally.

Extension of Bulkhead Wharf at Elevator No. 3.

As the elevator site extended beyond the west end of the original standard High Level Bulkhead Wharf, it was necessary to construct an extension of the existing High Level Quay Wall to the end of the Tarte Pier, a length of approximately 90'.

Although this work was not of great magnitude, it was of considerable difficulty, as the cribwork substructure was of the light low level type and quite unfit for carrying the ordinary standard mass concrete superstructure.

It was, therefore, necessary to devise a superstructure the superimposition of which would give the proper stability to the old structure, and this was accomplished by designing a broad hollow wall with sloping back and diaphragm walls, all of reinforced concrete, which satisfactorily met the conditions and was successfully constructed.

Completion of Extension to Imperial Oil Wharf at Montreal East.

This extension, carried out under contract by The Barnett-McQueen Co., was begun last year and almost completed, only 577 yards of mass concrete being required to complete the constructed superstructure and some 6,900 c. yds. (scow measurement) of rock to complete the fill.

The wharf was satisfactorily completed and handed over to the Commissioners by the contractors on 1st July.

The Commissioners' contractors also completed for the Imperial Oil Ltd. an extension of one of their main sewers before leaving the ground.

The completion of this work, which is fully described in the previous Annual Report, constitutes a total addition of 850 ft. to the accommodation of the Harbour.

RECAPITULATION OF WHARF CONSTRUCTION

	Num- ber	Length on Cope Line Lin. Ft.	Quantity Cu. Ft.
Cribs Built and Sunk:			
Shore Wharf, Sections 30-31.	5	700	742,396
Marine Tower Jetty, Elevator No. 3.....	1	731	1,080,000
<hr/>			
Total Cribwork built and sunk.....	6	1,431	1,822,396
<hr/>			
		Lengths on Cope Line Lin. ft.	
Quay Walls			
Partly built formerly, now completed:			
Extension of Alexandra Pier.....		761	
Extension of King Edward Pier....		815	
Extension of Imperial Oil Wharf...		222	
<hr/>			
Total completed.....			1,798
In progress:			
Shore Wharf, Sections 30-31.....		680	
Marine Tower Jetty, Elevator No. 3		731	
<hr/>			
Total in progress.....			1,411
<hr/>			
Total Quay Walls completed and in progress.....			3,209
Equal to 0.61 mile.			

NEW TIMBER STORAGE SHED ON BICKERDIKE PIER

The sawmill and timber storage shed, fully described in last year's Annual Report, was completed early this season, and the lessees having installed all the machinery and equipment, the plant during the past season has been in full operation.

NEW SHEDS Nos. 26 AND 27

The equipment of the berths at the Tarte Pier for grain loading necessitated the provision of accommodation elsewhere for lines not carrying grain that formerly were accommodated at the Tarte Pier.

It was, therefore, decided to build two additional transit sheds for this purpose, and the best available location was the bulkhead wharf immediately below Shed No. 25.



NEW TRANSIT SHEDS 26 AND 27 DURING CONSTRUCTION

Plans were, therefore, prepared for two new sheds at this site, to be known as Sheds 26 and 27, and a contract for the construction of the sheds was awarded to Messrs. Quinlan, Robertson & Janin Ltd. on 14th August, work being begun immediately thereafter.

These single deck twin sheds are entirely of reinforced concrete, the first of this type to be erected in the Harbour.

Each shed is 82' 8'' wide, having three spans, the central bay allowing a clear opening of 30', while it is 408' 8'' long, forming a building 817' 4'' in length under one roof, divided into 37 longitudinal bays of 22' span.

The floor of the shed is of concrete, laid 4' above wharf level on filling, and is topped with 1¾'' thickness of mastic asphalt. There is one entrance ramp common to both sheds and two individual exit ramps, one at each end of the building.

The entrance doors at head of ramps and also those on the railway or city side of the sheds are of the metal curtain or rolling-up type. Those on the river side are two section turnover doors made of a metal frame sheathed with galvanized iron, having large solid metal sashes on the top section. The same type of sashes were placed over the city side doors and in a one-sided monitor over the roof. The last mentioned ones are made to open by means of sash operators worked from the floor level.

The roofing is of the ordinary tar and gravel type and the water is carried down to the ground level through metal downspouts.

Reinforced concrete poles provided to carry the overhead wire of the adjoining electrified tracks were built as an integral part of the sheds, and a steel overhead cargo handling girder is to be installed on the whole length of the building on the river side.

Necessary offices and gear rooms have been provided which are to have a hot water heating system worked by oil burners.

These two sheds are already leased and will be ready for occupancy at the opening of navigation, 1924.

NEW WHARF OFFICE BUILDING

The Commissioners have for some time felt that the various unsightly wooden workshops and watchmen's shanties in the central part of the Harbour should be dispensed with, and accommodation made in one permanent building.

With this end in view plans were prepared in the fall and tenders called for an office building situated at the junction of the Victoria Pier and the high level wharves, Section 20.

The edifice decided upon was of an irregular shape, 104 feet extreme length and 54 feet extreme width, three storeys in height. The ground floor comprises a workshop for blacksmith, tinsmiths engaged in the repairs of the sheds and repairs to track tools. On this floor there is a private office and public office for the accommodation of the Superintendent of Transit Sheds and the Superintendent of Roads and Water Supply, also for the storekeeper and weighman. There is also a garage for two cars and a large storeroom on the ground floor.

The first floor is entirely for the use of the Police Department and comprises a large guard room, cell for the prisoners, store-room and public and private offices, also a kitchen for the men.

The second floor is fitted up with public and private office for time-keepers, checkers, etc., and the main portion is left unallotted, for future use.

The upper floors and roof are reached by a roomy stairway in the eastern tower, built of wrought iron with marble treads. The western tower reaches a height of 80 feet from the ground, and will be utilized for the drying of fire hose used in the supply of water to steamships.

The frame of the building is of reinforced concrete faced with grey sandstone and buff-coloured vitrified brick, and is entirely fire-proof. The wooden trimmings and interior doorways are of British Columbia pine stained and polished. Two furnaces have been installed for the general heating, and a water jacket for the supply of hot water during the summer months.

The toilet fittings are of the most modern kind, and include wash basins, toilets and shower bath. There are two sets of toilets on each floor, all supplied with hot and cold water, summer and winter.

A public weigh scale was built on this site last summer, and has been incorporated with the building, and a wrought-iron marquee erected over it. This will be operated for the convenience of Harbour traffic by the Commissioners.

The building was designed by Mr. Theo. Daoust, Architect,

Montreal, from directions given by Mr. Geo. E. Smart, Harbour Comptroller. The structure occupies a prominent position, and promises to be an ornament to the Port. It will be ready for occupation in April, 1924.

The whole work was carried out under contract by Messrs. Collet Frères, of Montreal, without a single claim for extras.

New Machine Shops at Harbour Yard, Notre Dame Street East

The ever-increasing maintenance and repair work of the Harbour elevator equipment, land construction plant, fleet, rolling stock and railways was severely taxing the capacities of the Commissioners' shops at the New Harbour Yard and on the Guard Pier. The climax in the situation was reached when the shops on the Guard Pier were destroyed by fire on 23rd May, and after the whole situation had been carefully considered, it was decided to concentrate all land repairs in



NEW HARBOUR MACHINE SHOPS

the shops at the Harbour Yard and only have equipment at the Guard Pier sufficient for dealing with ordinary repairs to the fleet.

Formerly it had been customary to do most of the repairs for the Elevator System and many other general Harbour repairs at the shops on the Guard Pier, and the obvious inconvenience and expense of transportation across the Harbour led, naturally, to the choice of a site on the north side as the most convenient location, and the enlargement of the facilities at the Harbour Yard was consequently decided upon.

Instead of simply extending the present building to accommodate such additional machinery as was necessary, it was decided to build a new wing to the existing building which would take care of the whole plant, so that the old machines located in the existing shop building could be moved into the new extension and placed alongside the new equipment, thus forming a complete unit under a single roof. In this way it is estimated that the cost of handling the pieces will be lessened, the supervision will be rendered easier and the area vacated can be used with advantage for much-needed storage space.

Plans and specifications, together with an estimate of cost, were prepared by the Commissioners' staff and a contract placed with Messrs. Quinlan, Robertson & Janin, Ltd.

The building, as now erected, has concrete foundation walls and piers, steel structure consisting of columns, roof trusses and purlins, plastic brick walls coped with tile, solid metal sash windows, concrete ceiling slab, with a tar and gravel roofing laid on a wooden roof sheathing.

The building is 240 ft. long and 40 ft. wide, centre to centre to columns, the area covered by the new roof being 245' 1½" by 45', and is divided into fifteen bays of 16' longitudinally and is one bay wide.

An overhead crane runway has been provided and the crane, of 12 tons capacity, has been purchased.

A concrete floor slab has been laid by the Commissioners and topped with an asphalt mastic flooring.

Proper sanitary accommodation has been provided in the old building for the men, and water, gas and air lines have been distributed along the shop, making it an ideally equipped and most modern plant.

The Superintendent and his clerical staff remain in the offices previously provided for in the old building.

The heating radiation and piping were installed in the new shop by the contractor, and the Commissioners have had installed in the old shop building a new boiler for the steam heating of the extension.

Ample ventilation and daylight have been provided for and the ceiling and upper part of the brick walls were painted white.

The following machines have been moved from the old to the new shop:—

1 open side planer.

3 engine lathes.

1 shaper.

1 bolt cutting machine.

1 radial drill.

1 power saw.

Emery wheels and miscellaneous small tools.

Belt driven power hammer.

Air compressor.

Forges.

The following have been purchased and placed in the new shop:—

36'' standard planer.

Arbor press.

Wood turning lathe.

Combination turret lathe.

72'' break lathe.

Slotting machine.

Pipe threading machine.

2 upright drilling machines.

Universal milling machine.

Radial drill.

Bolt threading machine.

Metal power saw.
Pneumatic power hammer.
Extension bed engine lathe.
Horizontal plate bending rolls.
Double-ended lever punching and shearing machine.
Rolls for tinsmith.
Drill grinder.
Small miscellaneous tools.

RAILWAYS

South of Lachine Canal.

The necessary railway facilities for the operation of the new timber depot on Bickerdike Pier, together with a siding connecting the mill with the lumber yard situated near the Victoria Bridge, were completed, about 6,870 lin. ft. of track being laid during the season, and the installation of an additional coal tower by the Canadian Import Co. necessitated



COAL VESSELS BEING UNLOADED

the doubling of the railway on the north side of the pier, the laying of 943 lin. ft. of additional track being required.

Three new storage sidings were also laid for the Canadian National Railways near Mill Street, the total length of additional track being 1,542 ft.

Elevator No. 2.

The improvement and remodelling of the railway connections to the west end of Elevator No. 2 and to Sheds 13 and 15 necessitated the removal of 1,540 lin. ft. of track and the laying down of 1,925 lin. ft. of new track. The work involved also the lifting and relaying of 2,050 sq. yds. of paving.

Grain Sidings.

The double line of track laid some years ago on Commissioners' Street outside the Flood Wall had been operating until this season by means of a connection with the Harbour main line at McGill Street and a crossover about midway, opposite Elevator No. 1, but at the east end, opposite Elevator No. 2, there was no direct connection with the Main Lines, which at times resulted in very awkward operation.

The Flood Gate opposite the west end of Elevator No. 2 was accordingly widened from 26' to 57' 6' and a spur connecting the two grain sidings with the Main Line laid down. Additional water-tight panels for the Flood Gate were constructed for the Commissioners by the City Authorities. The grain sidings outside the Flood Wall now form a complete loop line with the main line between Elevator No. 2 and McGill Street.

Dominion Coal Co.'s Wharf at Section 37.

The existing low level main lines were laid in heavy section rail and an additional siding laid down to serve under the coal towers.

Railway Yard at Elevator No. 3.

The whole area of the low level wharf extending between Sutherland and Laurier Piers had to be filled up to standard

high level to form the site for the new elevator and the necessary storage sidings, while the railway embankment, as far west as Desery Street, had to be widened for the necessary railway connections from the west, and no less than 74,970 cu. yds. (scow measurement) of material was deposited.

Not the least difficult of the problems encountered in connection with the establishment of the new elevator was the maintenance of both railroad and vehicular traffic to the Tarte Pier while these operations were in progress. The low level main line track had to be removed from a point east of Desery Street to Pius IX Avenue and traffic diverted by a railroad ramp to the high level, while the connections from the Tarte Pier, after various temporary arrangements, were ultimately connected also to the high level railway.

The Nicolet Street Subway had to be closed and a road ramp constructed leading from Pius IX Avenue Subway to the Tarte Pier, and during the whole course of the operations there was constant manipulation of tracks and roadway as the operations progressed.

By the end of the season the filling of the area was almost completed and a commencement had been made with laying the sidings from both the east and west ends.

Canada Cement Co.'s Wharf at Montreal East.

Until this season, the crossing of the Cement Co.'s tracks leading to the wharf and the Harbour Commissioners' main line was confined to a single track crossing branching out on both sides to a double track, but traffic on this section of the railway had become lately so intense as to render the continuation of the double track Main Line right through imperative.

The second diamond was, therefore, installed and the necessary adjustment made to the various sidings connecting therewith and the Overhead Catenary Lines altered to meet the new arrangement.

Industrial Sidings.

A new railway siding was constructed for the Dominion Tar & Chemical Co., who are erecting a plant alongside the

Shell Oil Co. in the vicinity of Racine Pier. The spur is about 690 ft. in length, 242 ft. of which is on Harbour property.

A small spur was also laid for the Hospice St. Benoit at Section 79.

SUBWAYS AND RETAINING WALLS

Aylwin Street Subway.

The formation of the railway yard for Elevator No. 3 necessitated the lengthening of the Aylwin Street Subway 75' to 80' and the construction of wing retaining walls east and west thereof to retain the fill required for the widening of the railway embankment.

The length of the east wing wall is 240' and the west wing wall 260'.

The amount of mass concrete put in place was 3,270 cu. yds., and 1,880 cu. yds. of excavation was necessary.

Two of the four railway bridges required for spanning the extension of the subway have been put in place.

Papineau Avenue Subway.

The erection of new Sheds 26 and 27, opposite Papineau Avenue Subway, necessitated the construction of a retaining wall to form the south side of the ramp entrance to the high level wharf from this subway.

The length of the wall as constructed was 370' and the amount of mass concrete placed was 900 cu. yds., while 1,450 cu. yds. of excavation was necessary.

SEWERS

At the beginning of this year no steps had been taken by the City Authorities to proceed with the reconstruction of the Nicolet Street sewer and the extension of the Duquesne Street sewer, the only two important outfalls still requiring to be dealt with, but the authorization of the construction of Elevator No. 3 compelled the Commissioners to press for the

immediate reconstruction of the Nicolet sewers, and negotiations were immediately entered into with the City Authorities, with the result that the Commissioners, under agreement, undertook the work for the city.

The former sewer ran in a straight line from Nicolet Street Subway to the outfall in the high level bulkhead wharf, traversing the site of the new elevator. A diversion had, therefore, to be made to clear the side of the elevator, and the course of the new sewer runs parallel with the original railway embankment to the vicinity of the Laurier Pier, where it runs approximately at right angles and discharges into the river through the old low level wharf, a short distance above the Laurier Pier.

The sewer, with the exception of 38' at the outlet, is of circular brick construction, 6' in diameter, the wall being $13\frac{1}{2}$ " thick, while the section at the outlet, 38' in length, consists of a circular steel pipe 6' in diameter. At the junction of the steel pipe with the brick sewer there is a specially reinforced brick collar, 4' in length and 24" thick, in which the flange of the steel pipe is incorporated.

The quantity of material excavated was 4,478 cu. yds., the length of the brickwork section 1,040 lin. ft. and the steel pipe section 38'.

Nothing has yet been done regarding the extension of the Duquesne Street sewer, but it is understood that the City Authorities contemplate undertaking the work during next season.

PAVING

The increased traffic on the Bickerdike Pier, resulting from the expansion of the coal business and the addition of the timber business, necessitated provision of better vehicular approaches, and a paved roadway 24' in width was constructed from the new timber depot the full length of the pier and crossing the Harbour property to Mill Street. In all, about 9,475 sq. yds. of paving with granite blocks was done.

The paving of the wharf having been continued last year to the west end of Shed 24, the roadway behind Sheds 24

and 25 was paved in continuation during the past year. In order to make the most of the space available, the tracks alongside the sheds were placed at minimum centres and hydrants were transferred to the north side of the roadway, thus increasing the available width from 3' to 6,' and providing a roadway throughout approximately 30' in width. An area of 2,650 sq. yds. of granite block paving was done.

The eastern approach to the Cold Storage Warehouse, the structural work of which was completed last season, was paved during the year. 300 sq. yds. of granite block paving and 322 sq. yds. of asphalt on concrete base were required.

20-TON AUTO TRUCK SCALE ON VICTORIA PIER

To meet the demands of the shippers, a modern auto truck scale was installed at the head of the ramp on Victoria Pier. The description of the scale is as follows:—

Capacity.....	20 tons
Size of platform.....	24' x 9'
Type.....	Rigid bearing

Some 11 yards of concrete entered into the foundation of this scale, necessitating the removal of 36 sq. yds. of scoria block paving and concrete base, together with 36 yds. of earth excavation.

EXTENSION OF WATER MAIN ON BICKERDIKE PIER AND AT SECTIONS 26-27

The extension of the Water Supply System on Bickerdike Pier, consisting of 2,100 lin. ft. of 12'' main, with all necessary fittings for connecting to hydrants, monitor nozzles, etc., as well as branch supplies, was completed, and in addition there was an extension of the water main at Sections 26 and 27 to serve the new sheds in course of erection.

DREDGING AND FILLING

Dredging operations were begun on 7th May by dredge "John Kennedy," and by the middle of June a fleet of three dredges and five derricks, with their attendant tugs, were operating and continued till the close of the season.

Towards the latter part of the season, in order to accomplish the necessary work, the hours of a number of the vessels had to be considerably extended.

With the exception of preparing crib sites, new dredging was entirely confined to the Bickerdike Pier Extension and the widening of the channel in the Central Harbour.

The floating derricks, in addition to disposing of the dredged material in the various items of back fill and embanking, also assisted in large measure with wharf construction in the sinking and ballasting of cribs, and the handling and placing of reinforced concrete shells, as well as disposing of ships' ballast and scavengings from the wharves.

The following are the quantities of dredging and filling for the season:—

Dredging.

	Cu. yds. (scow)	Cu. yds. (scow)
Rock:—		
Bickerdike Basin	246,125	
	<hr/>	
Total Rock Dredged		246,125
Other Material:—		
Bickerdike Basin	56,250	
Crib Seats, Sections 30-31	4,830	
do Marine Tower Jetty, Elevator No. 3	15,350	
Opposite Shipyard	6,400	

Maintenance: Sections 5-6...	6,195	
do 9-10...	1,870	
do 10-13.	28,910	
do 44.	6,110	
Dry Dock Basin	5,620	
Imperial Oil		
Channel.....	50	
<hr/>		
Total Maintenance Dredging.	48,755	
<hr/>		
Total Other Material Dredged.....		131,585
<hr/>		
Grand Total of Dredging.....		377,710

Filling.

Rock. (by Derrick):—

Alexandra Pier.....	13,150	
King Edward Pier.....	50,425	
Sections 26-27.....	4,650	
do 30-31.....	85,775	
do 40-44 (Raising to High Level).....	39,200	
Behind Bulkhead at Elevator No. 3	1,800	
Marine Tower Jetty, Elevator No. 3	31,075	
Elevator No. 3 (behind).....	12,300	
Imperial Oil Wharf.....	6,600	
Pointe-aux-Trembles Wharf (Pro- tecting end).....	900	
Behind Crib, North side No. 2 Lock	250	
<hr/>		
Total Rock Filling.....		246,125

Other Material. (by Derrick):—

Alexandra Pier.....	43,925
King Edward Pier.....	13,075
Section 26.....	700
Sections 30-31.....	6,975
do 40-44 (Raising to High	

Level).....	18,695
Marine Tower Jetty, Elevator No. 3	2,125
Elevator No. 3 (behind).....	900
Imperial Oil Wharf.....	300

Total Other Material by Derrick.....	86,695
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(By Dump Scow):—

Victoria Pier (Protecting end).....	25,810
Marine Tower Jetty, Elevator No. 2	
(end).....	8,940
To spoil (South side of channel)....	10,140

Total Other Material by Dump Scow..	44,890
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Grand Total Other Material to Filling.	131,585
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Gd. Total Material Dredged to Filling	377,710
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Sundry Items of Filling.

	Cu. yds. (scow)	Cu. yds. (scow)
(Ballast, by Derrick):—		
Bickerdike Pier (Tracks).....	75	
Guard Pier.....	1,000	
Alexandra Pier.....	2,600	
King Edward Pier.....	1,450	
Section 26.....	200	
do 30.....	1,100	
do 42.....	300	
Elevator No. 3 (behind).....	400	
	<hr/>	
Total Ballast.....		7,125

Other Material (by Derrick):—

Alexandra Pier.....	600
Section 26.....	300
do 31.....	150
do 40-44.....	775

Marine Tower Jetty, Elevator No. 3	2,075	
Elevator No. 3 (behind) (From PWD No. 123).....	600	
	<hr/>	
Total Other Material.....		4,500
Wharf Refuse (by Derrick):—		
To spoil.....	4,220	
	<hr/>	
Total Wharf Refuse.....		4,220
		<hr/>
Grand Total Sundry Items of Filling		15,845

Earth, Cinders, etc., from City Contractors (by Team)

Windmill Point.....	9,150 cu. yds. (estimated)		
Alexandra Pier.....	30,000	do	do
King Edward Pier.....	34,000	do	do
Sheds Nos. 26 and 27.....	7,000	do	do
Sections Nos. 27-29.....	79,300	do	do
	<hr/>		
Total Filling by Teams.....	159,450	do	do

Areas Dredged.

	LOCATION	Area Dredged Square Yards
New Work:		
Channel to Bickerdike Basin.....		18,789
Widening Channel in Central Harbour.....		7,594
Crib Seats: Sections 30-31.....		4,950
Marine Tower Jetty, Elevator No. 3		4,200
Maintenance Dredging:		
Windmill Point Basin, Section 11S.....		1,466
do do 5-8.....		11,875
do do 9-10.....		489
Berth No. 5.....		2,800
do No. 4.....		1,511
Tarte Pier, West Side.....		5,467
Dry Dock Sinking Basin.....		14,167
Imperial Oil Wharf Channel.....		10,667

COLD STORAGE WAREHOUSE

Pump for River Water.

This installation has been completed and satisfactory tests made. The well and air compressor plant is now regarded as a reserve means of supply, being run only at regular intervals to keep in condition. A considerable economy is effected by using the river water, and the extent of the supply is limited only by the capacity of the pump, which is 600 U.S. gallons per minute.

A small concrete shelter was erected for this pump, with a floor area 9' x 11' and about 26' high. 29 cu. yds. of concrete went into this structure and 45 cu. yds. of earth excavation was removed.

Steel Gates at Entrances.

Steel gates were erected at the east and west entrances of the covered roadway at the south side of the warehouse in order to prevent the use of the roadway as a thoroughfare and confining its use entirely for vehicular traffic to and from the warehouse.

ELECTRICAL DEPARTMENT

Power and Operation.

The Harbour Commissioners purchased, under contract, electric power from the Montreal Light, Heat & Power Co. for their requirements, as follows:—

	1921	1922	1923
	H.P. Hrs.	H.P. Hrs.	H.P. Hrs.
Cold Storage Warehouse . .	346,358	3,135,185	2,966,589
Elevator No. 1	2,157,977	2,307,364	2,463,493
Conveyors	964,120	1,716,515	1,009,900
Freight Hoists	55,080	87,543	113,637
Harbour Lighting	159,710	412,946	631,821
Miscellaneous	25,915	45,391	136,396
Elevator No. 2	1,978,803	2,444,789	2,008,331
Engine Shops	55,200	49,250	50,274
Harbour Yard	42,136	45,207	78,500
Sheds Nos. 2 to 15	135,301	294,074	294,059

Sheds Nos. 16 to 19.....	53,811	60,052	54,564
Sheds Nos. 24 and 25....	.....	19,573	23,165
Railway Electrification...	.....	190,500	1,561,035
Head Office: Power and Lighting.....	.....	21,173	32,931
Elevator "B" and Con- veyors.....	.....	.....	1,324,174
Elevator "B" Extension (Construction).....	.....	.....	13,985
Elevator No. 3 (Construc- tion).....	.....	.....	33,718
British Empire Lumber Corp. Ltd.....	.....	.....	220,216

Lighting of the High and Low Level Wharves.

All the lighting of the High and Low Level Wharves for the season of 1923 was carried out by the Harbour Commissioners' Electrical Department, and the power for the lighting units was supplied through the several sub-stations. The number of lamps in service varied slightly during the season, from 200 to 227 maximum:—

No. 1 Series Circuit, 51 lamps—Windmill Point and Bick-
erdike Pier.

No. 2 do 36 do McGill Street to No. 1
Elevator.

No. 3 do 49 do No. 1 Elevator to Section
19.

No. 4 do 26 do Section 19 to Section 22.

Nos. 5 do 65 do Section 22 to Sutherland
& 6 Pier.

Electrification of Railways.

The electrified portion of the Harbour Railway Terminals extending from Section 19 to Section 101 was in operation during the season. Two 83-ton locomotives were in operation and their performance was very satisfactory.

Sub-Stations.

A new sub-station was erected on Bickerdike Pier for the power requirements in this section. This station is supplying approximately 1,000 H.P. to the Sawmill.

Elevator "B" Sub-Station.

On March 1st, 1923, the Commissioners took over the Grand Trunk Elevator, known as Elevator "B." This elevator was operated by the small sub-station built for the original requirements, but from time to time additions had been made to the original system, and during the summer of 1923 further important extensions in storage, shipping and conveyor galleries were made.

This necessitated considerable extra power, which the old station was unable to supply. A new sub-station was, therefore, built and is being equipped to handle the full requirements of Elevator "B" and the local demands of that district, amounting to approximately 5,000 H.P.

High Tension Transmission Lines.

The transmission, distribution and feeder lines were extended to meet the requirements of the various companies using power or lighting, as well as for our own needs, the distribution being as follows:—

No. 1 Station.....	6,250 H.P.
2 do	3,650 "
3 do	700 "
4 do	4,050 "
5 do	4,500 "
<hr/>	
Connected Load.....	19,150 H.P.

Freight Hoists in Connection with Transit Sheds

Year.	Total Teams Carried	No. of Days Oper- ated	K W.Hrs.	H.P.Hrs.	Commen- ced Opera- ting	Ceased Opera- ting	
No. 1 Hoist, Shed No. 12 (Single Team Hoist)							
1921.....	3,312	188	5,250	7,041	Apr.	22 Nov.	
1922.....	4,325	194	8,100	9,519	Apr.	25 Dec.	
1923.....	5,648	197	12,350	16,556	Apr.	25 Dec.	
No. 2 Hoist, King Edward Pier (Single Team Hoist)							
1921.....	13,462	195	24,150	32,377	Apr.	23 Dec.	10
1922.....	19,156	197	34,800	46,648	Apr.	24 Dec.	9
1923.....	18,265	196	41,550	55,877	Apr.	26 Dec.	11
No. 3 Hoist, Alexandra Pier (Double Team Hoist)							
1921.....	5,742	191	4,980	6,679	Apr.	25 Dec.	3
1922.....	10,049	193	7,730	10,362	Apr.	28 Dec.	9
1923.....	14,155	193	8,930	11,972	Apr.	27 Dec.	8
No. 4 Hoist, Jacques Cartier Pier (Single Team Hoist)							
1921.....	2,608	192	2,180	2,924	Apr.	22 Dec.	6
1922.....	3,675	189	3,020	4,049	Apr.	24 Dec.	2
1923.....	5,857	189	4,545	6,094	Apr.	27 Dec.	3
No. 5 Hoist, Alexandra Pier (Double Team Hoist)							
1921.....	2,706	187	1,500	2,012	Apr.	22 Nov.	29
1922.....	3,675	187	2,340	3,137	Apr.	26 Dec.	2
1923.....	4,219	186	2,700	3,616	Apr.	26 Dec.	1
No. 6 Hoist, Sheds Nos. 24 and 25 (Double Team Hoist)							
1921.....	4,746	184	3,800	5,094	Apr.	27 Nov.	30
1922.....	5,628	190	3,750	5,025	Apr.	27 Dec.	2
1923.....	6,582	196	4,450	5,965	Apr.	24 Dec.	8
No. 7 Hoist, Sheds Nos. 16 and 17 (Double Team Hoist)							
1921.....	4,217	177	1,935	2,593	May	5 Dec.	3
1922.....	5,011	188	1,965	2,633	Apr.	26 Dec.	2
1923.....	7,573	189	3,900	5,293	Apr.	27 Dec.	6
No. 8 Hoist, Sheds Nos. 18 and 19 (Double Team Hoist)							
1921.....	1,046	76	1,010	1,354	June	18 Sept.	13
1922.....	7,478	192	4,600	6,170	April	28 Dec.	9
1923.....	9,902	192	6,500	8,714	April	28 Dec.	9

MAINTENANCE

Wharves.

In addition to the ordinary patching and general maintenance, there was quite a heavy list of more serious repairs necessary, the more important items being:—

Drove 12 clusters of piles at the Guard Pier for mooring purposes.

Extensive repairs to cribwork at Section 12, foot of McGill Street, and lowering stairs for access to small craft; Montreal Light, Heat & Power dock at Section 34 and placing 2 moorings at Section 33 for oil boats; Section 39, low level; Section 40, low level, and filling with stone; Section 42, outer end, west side of Laurier Pier.

Repaired upper side of Pointe-aux-Trembles wharf, laying 2,500 ft. B.M. of decking, placing steel sheeting on upper corner and filling at back and upper end of wharf as a protection against the ice.

Filled voids under stone wall at the Canal entrance.

Renewed flooring on all three bridges of marine tower jetty extension at Elevator No. 2 and built one new section to connect the last two piers. Put on steel plates on two outer corners of Ice Breaking Pier and two ladders on the sides. Put in two new mooring posts on outer end of Tower Pier.

Lowered slipway for Boucherville Ferry 18'', on account of very low water.

Made two new fender posts for Longueuil Ferry and laid plank sidewalk 60' by 4' across the roadway to the street.

Drove 20 piles at Laurier Pier to close mouth of spillway through the wharf and put waling over these to protect from ice.

Put a hood and waling over the outlet of the Nicolet Street sewer to protect from ice.

Put in 200 lin. ft. of coping at Sheds 3 and 5 and replaced 6 moorings which were deteriorated; also 2 moorings which had been carried away by vessels due to surge when Canal gates were carried away.

Repaired 250' of wharf face and made foundations for 4 moorings on water front of Shed 7; and made foundations for 2 moorings at Shed 9.

Replaced 150' of coping at Sheds 8 and 10 and replaced one mooring at Shed 10.

On account of the construction of the Conveyor System at Windmill Point had to change position of 11 mooring posts to clear the foundations of columns.

Made examination of wharf at Windmill Point to locate raceways in connection with conveyor foundations.

Had 170 loads of stripping from the streets in Longueuil spread over the surface of the Government wharf at Longueuil.

Sheds and Elevators.

The usual force was employed on maintenance of sheds and elevators, and, in addition to the ordinary routine repairs and painting, a few larger items, such as replacing 125 old doors by new steel doors, sealing of skylights Sheds 2 to 15 and replacing corrugated iron on city end of Shed 13 with brickwork.

Railways.

The usual routine of maintaining switches and slip diamonds, renewing ties, rails, etc., and surfacing in general was carried out during the season, the renewal of ties this season being unusually heavy.

General.

The general cleaning, watering and upkeep of the high and low level roadways was kept up during the season.

Shed sweepings and dunnage from all sheds were carted away.

All drains, gullies, etc., were kept clear and flushed with the fire hose as required.

All water connections throughout the Harbour were kept in good order.

All water meters were read at the end of each month and checked up with the City's readings.

All public latrines between Sections 4 and 45 were connected up by the 15th May and disconnected by the 25th November. These were all flushed out twice daily and kept clean and in good order.

Water service in the sheds was connected up and water turned on by 15th May and disconnected by 10th December, except Sheds 2, 8 and 18, which remain on for the winter.

567 services of water were given to vessels lying between Sections 4 and 46, amounting to 2,298,900 cubic feet.

Life Saving Equipment.

Every precaution was taken to facilitate the saving of life and the prevention of accident by the erection of railings and the distribution of ropes, gaffs and life preservers at 120 different points along the water front. During the season the lives of seven persons were saved, but it is regrettable to report that these efforts were again much frustrated by the frequent theft of various articles of this equipment.

Fire Prevention, etc.

In addition to the 38 five-nozzle and 9 low fire hydrants between Sections 4 and 45, a 500' hose reel with all appurtenances is stationed on each of the piers in the Central Harbour, while 33 20-gallon fire extinguishers are installed in the transit sheds and elevators. These are inspected daily, are in constant readiness, and their speedy use has on many occasions prevented serious damage.

The City Fire Department were called to the Harbour a number of times during the season, but no damage was done to Harbour property.

The quick acting gates in the Flood Wall are kept in good working order at all times.

The usual force of watchmen, etc., was employed to protect the property of the Commissioners, to guard the public from accident and to regulate the Harbour dumping grounds.

Harbour Yard

The following is a general outline of the work done in this department during 1923:—

Dismantling, overhauling and repairing of locomotive cranes; general maintenance of wagons, water carts, snow plows, concrete mixers, steam roller, dump cars, hydrants,

etc.; repairs to electric locomotives; machine work on boom winches for floating derricks; miscellaneous shop work for elevators.

Also transferring of machinery from old Machine Shop to new shop to fit in with the scheme of an enlarged and improved shop to cope with the increased demands on this department.

Maintenance Dredging

The large programme of construction undertaken during the season, requiring large quantities of material for fill, very fully occupied the dredging fleet and attendant tugs, and it was frequently difficult to obtain towing service for testing.

Nevertheless the main portion of the Harbour from the head of Windmill Point Basin to the end of Victoria Pier was gone over and all obstructions of consequence removed, while considerable quantities of maintenance dredging were also done at the Tarte Pier and Dry Dock Basin.

The quantities of material dredged and areas covered, as well as the manner of disposal, are shown in the tabulated statement of dredging and filling.

DREDGING FLEET

The following vessels wintered on the shipways:

Derrick No. 3
do No. 4
do No. 5
Tug "Robert MacKay"
Drilling and blasting boat.
Derrick No. 1

The more important repairs to the vessels of the dredging fleet during last winter were the following:

The hulls of Derricks Nos. 3, 4 and 5 were rebuilt and the wooden booms, stiff legs and "A" frames on Derricks Nos. 3, 4, 5 and 6 were replaced by steel members. Boom winches, new boilers, heaters, feed pumps and electric lighting sets were fitted to these derricks.

Derricks Nos. 3, 4, 5, 6 and 8 are now thoroughly modern in equipment and the season's running showed satisfactory performance.

Dredge "John Kennedy" was also fitted out with a new $7\frac{1}{2}$ KW. lighting set.

Dredge No. 6 was placed in dry dock on May 15th and launched on May 23rd, after repairs, scraping and painting.

Dredge No. 5 was pulled up on ways for hull repairs on May 11th and completed on May 26th.

Tug "Sir Hugh Allan" was placed in dry dock for fitting new propellers, scraping and painting, on November 8th.

The boiler of the S.Y. "Bethalma" was re-tubed on August 11th.

The usual temporary repairs to the vessels of the dredging fleet were carried out during the season as occasion demanded, with practically no interruptions to operations.

On May 23rd the Machine Shop and Carpenter Shop on the Guard Pier were entirely destroyed by fire. The old buildings were of wooden construction throughout, and in spite of the best efforts of the Commissioners' fire tug and the City Fire Department, the destruction was complete. This loss caused some inconvenience in the carrying out of the programme of work, but a floating shop was quickly completed, and no serious interference with the work of the Port in any department was occasioned. A large flat scow was completely equipped as a floating machine shop to work in conjunction with the Shipyard, which is located here, and where all floating plant will be maintained and repaired, and a Store house and carpenter shop were erected on the Guard Pier, the motive power being steam.

On December 13th, the tug "Robert MacKay," while towing a barge to the Canadian Vickers' Dry Dock, capsized and sank. The task of raising this tug was a very difficult one, owing to the strong current at this point, but this was finally accomplished on December 26th, and the vessel is now on the shipways for the winter.

THE FLOATING CRANE

The Floating Crane, installed as an adjunct to the Port in 1909, has again proved itself a most valuable Harbour utility.

The following is the record of the Floating Crane for the season 1923:—

Number of working days.....	210	
Number of days working.....	137	
Number of hours working.....	683	
Percentage of time in actual operation.....	65%	
Total number of lifts:—		
Commercial.....	964	
Commissioners' service.....	140	
Average weight of lifts:—	Tons	Cwts.
Commercial.....	7	9
Commissioners' service.....	6	1
Greatest lift:—		
Commercial.....	60	0
Commissioners' service.....	60	0
Greatest tonnage from single ship:—S.S.		
"Canadian Coaster".....	1,128	0
Total weight lifted during season 1923.....	8,608	0
Commercial.....	7,663	
Commissioners' service.....	945	
Total weight lifted during season 1922.....	5,778	0

The following table shows the maximum and average number of workmen employed by the Harbour Commissioners during the season of 1923:

	Maximum	Average
Maintenance of Harbour.....	198	119
Maintenance of Steel Sheds.....	17	13
Harbour Yard:—		
Carpenters, Blacksmiths, etc....	55	40
Sawmill and Timber Boom.....	17	12
Round House:—		
Machinists, etc.....	38	26
Machine Shop.....	90	60
Shipyard.....	84	64
Dredging Fleet:		
Dredges, Tugs, etc., Crews.....	135	120
Elevator No. 1.....	38	32
do Shovellers.....	16	13
Elevator No. 2.....	39	37
do Baggers.....	46	14
do Shovellers.....	33	20
Elevator "B".....	32	29
do Shovellers.....	46	23
Conveyor Galleries.....	52	49
Electrical Department.....	123	116
Traffic Department.....	120	108
Cold Storage Warehouse: Operation and Maintenance.....	45	36
Construction of Wharves, Tracks, etc.	292	195
do Elevator "B," Con- veyors, etc.....	170	115
do Elevator No. 3.....	362	194
Police.....	51	49

NOTE:—The above figures do not include the men working for the different contractors on Harbour construction.

WATER LEVELS

The depth of water for navigation in the Montreal Harbour Ship Channel and on the Sill of Lower Lock Lachine Canal is given in the following table:—

	Depth on Old Lock Sill, Lachine Canal				Depth in Harbour Channel			
	Average 1901-1922		Average 1923		Average 1922		Average 1923	
May.....	20'	0"	20'	6"	35'	2"	35'	11"
June.....	18'	6"	17'	3"	32'	7"	32'	8"
July.....	16'	7"	15'	0"	31'	7"	30'	5"
August.....	15'	7"	13'	11"	30'	5"	29'	4"
September.....	14'	11"	13'	10"	29'	8"	29'	3"
October.....	14'	11"	13'	2"	29'	3"	28'	7"
November.....	15'	0"	13'	2"	28'	9"	28'	7"

SAWMILL

The Variable Belt Feed Portable Sawmill installed in March, 1922, to replace the permanent sawmill destroyed by fire in 1920, was used during the season, and met all requirements.

APPRECIATION

The foregoing review of the year's achievements would not be complete without an expression of appreciation of the manner in which the exacting duties and harassing problems of the year were mastered by the staffs of the different Departments.

From the opening until the close of navigation the daily work of the staff was characterized by a loyal and courageous devotion to duty, and the Commissioners desire to pay tribute to their zeal, efficiency and co-operative spirit.

1923

PORT OF MONTREAL

Statement showing the Nationalities and Tonnage of Sea-going
Vessels that arrived in Port during the season of 1923,
which were navigated by 66,929 seamen.

Nationality	Number of Vessels	Tonnage
British.....	836	2,979,660
Norwegian.....	77	178,716
American.....	57	131,157
Italian.....	30	100,105
Danish.....	27	50,266
Dutch.....	22	61,114
French.....	16	41,490
Danzig.....	14	72,368
Japanese.....	10	36,831
Greek.....	6	20,170
Swedish.....	6	11,797
Spanish.....	5	18,398
Jugo-Slavia.....	4	10,766
Belgian.....	2	6,234
German.....	2	4,238
Finnish.....	1	2,782
Latvian.....	1	1,448
Cuban.....	1	1,200
	1,117	3,728,740

Of the above, 1,092 were built of iron or steel, with a tonnage of 3,726,339,
and 25 were built of wood, with a tonnage of 2,401.

1923

PORT OF MONTREAL

Statement showing the classification of Trans-Atlantic Vessels that arrived in Port during the past ten years.

Year	Steamships		Barques		Ships and Brigs		Schooners		Grand Total	
	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	Vessels	Tonnage
1914.....	551	2,039,133	..	....	..	....	..	....	551	2,039,133
1915.....	483	1,656,634	..	....	1	1,094	..	....	484	1,657,728
1916.....	569	1,965,161	..	....	..	....	..	....	569	1,965,161
1917.....	579	1,984,233	..	....	..	....	..	....	579	1,984,233
1918.....	644	1,910,621	..	....	..	....	..	....	644	1,910,621
1919.....	702	2,041,638	..	....	..	....	..	....	702	2,041,638
1920.....	637	2,018,861	..	....	1	1,658	..	....	638	2,020,519
1921.....	807	2,598,494	..	....	..	....	..	....	807	2,598,494
1922.....	968	3,451,703	..	....	..	....	1	1,356	969	3,453,059
1923.....	872	3,199,063	..	....	..	....	..	....	872	3,199,063

1923

PORT OF MONTREAL

Statement showing classification of Vessels that arrived in Port, for the past ten years, from the Lower St. Lawrence and Maritime Provinces.

Year	Steamships		Schooners		Grand Total.	
	No.	Tonnage	No.	Tonnage	No.	Tonnage
1914.....	321	712,327	44	4,058	365	716,385
1915.....	312	601,916	19	1,630	331	603,546
1916.....	97	165,473	32	3,822	129	169,295
1917.....	34	23,635	34	2,899	68	26,534
1918.....	18	20,589	12	2,272	30	22,861
1919.....	62	134,971	22	2,671	84	147,642
1920.....	19	10,724	6	486	25	11,210
1921.....	151	292,870	6	592	157	293,462
1922.....	223	479,333	2	245	225	479,578
1923	242	529,383	3	294	245	529,677

1923

PORT OF MONTREAL

Combined Statement showing the number and tonnage of all vessels that arrived in Port during the past ten years.

Year	TRANS-ATLANTIC		MARITIME PROVINCES		INLAND		GRAND TOTAL	
	Vessels	Tonnage	Vessels	Tonnage	Vessels	Tonnage	Vessels	Tonnage
1914.....	551	2,039,133	365	716,385	12,225	6,288,939	13,141	9,044,457
1915.....	484	1,657,728	331	603,546	8,572	4,222,426	9,387	6,483,800
1916.....	569	1,965,161	129	169,295	7,297	3,558,872	7,995	5,693,328
1917.....	579	1,984,233	68	26,534	6,274	3,206,542	6,921	5,217,309
1918.....	644	1,910,621	30	22,611	6,102	3,313,908	6,776	5,247,390
1919.....	702	2,041,638	84	137,642	7,499	4,357,734	8,280	6,537,014
1920.....	638	2,020,519	25	11,210	4,403	4,287,714	5,066	6,319,443
1921.....	807	2,598,494	157	293,462	4,577	6,843,494	5,541	9,735,450
1922.....	969	3,453,059	225	479,578	5,789	9,157,062	6,983	13,089,699
1923.....	872	3,199,063	245	529,677	5,609	8,195,308	6,726	11,924,048

PORT OF MONTREAL

Statement showing the dates of the Opening and Closing of Navigation, the First Arrival and the Last Departure for Sea; also the greatest Number of Vessels in the Port at one time, during the past ten years.

Year	Opening of Navigation	Closing of Navigation	First Arrival from Sea	Last Departure for Sea	Greatest number of Vessels in Port at one time			
					Seagoing		Inland	
					No.	Date	No.	Date
1914.....	April 22nd	Dec. 15th	April 29th	Dec. 4th	56	Aug. 21st	94	Aug. 17th
1915.....	" 11th	" 15th	" 30th	" 11th	34	Sept. 21st	66	July 26th
1916.....	" 22nd	" 18th	May 1st	" 6th	41	" 12th	62	" 25th
1917.....	" 19th	" 7th	" 1st	" 7th	37	Nov. 12th	52	Sept. 11th
1918.....	" 21st	" 17th	" 7th	" 14th	46	" 7th	50	Oct. 10th
1919.....	" 14th	" 12th	April 22nd	" 10th	35	June 12th	54	Aug. 24th
1920.....	" 18th	" 11th	" 25th	" 11th	43	Aug. 18th	43	Sept. 14th
1921.....	March 29th	" 14th	" 21st	" 8th	78	Sept. 7th	43	July 16th
1922.....	April 13th	" 6th	" 24th	" 2nd	91	Oct. 24th	55	Aug. 21st
1923.....	" 29th	" 18th	May 3rd	" 1st	63	May 23rd	52	" 4th

LIST OF HARBOUR COMMISSIONERS FLOATING PLANT

1923

Description of Vessel	Hull.			When built	Engines				Capacity of Bucket	Depth to which Dredge can work	Remarks	
	Length	Breadth	Depth		Kind of Engine	No. of cylinders	Dia. of cylinders	Length of stroke				Pressure of steam
Dredges												
Boom Spoon Dredge J. Kennedy	90	0 36	0 10	3	1892	{ 2	16	18	128	7	Steel Hull, Rblt. 1923	
" " No. 5	104	0 36	0 10	9	1910		16	18	140	7	Steel Hull.	
" " No. 6	104	0 39	0 10	9	1912		16	18	140	7	Steel Hull.	
Derricks												
Clam shell Derrick No. 1	76	0 27	6 8	0	1899	{ 2	12	14	110		Wooden hull.	
" " No. 3	76	0 27	6 8	0	1900		12	14	110		Wooden hull. } Rebuilt 1923	
" " No. 4	75	0 26	10 7	6	1892		12	14	110		Wooden hull.	
" " No. 5	75	0 26	10 7	6	1892	{ 2	12	14	110		Wooden hull.	
" " No. 6	75	0 26	10 7	6	1892		12	14	110		Wooden hull.	
" " No. 8	88	0 31	0 9	8	1915		12	14	140		Wooden hull.	
Drilling & Blasting Boat	80	0 27	0 5	6	1895	.....	.....	.....	100		Three 5 in. steam drills. Rebuilt 1923
Steam Yacht "Bethalma"	110	4 16	5 10	2	{ Purch. 1923	{ 1	9	18	200		Steel hull. Rebuilt 1921	
							14½	25				
							1					
Tug Boats												
Tug "St. Peter"	74	8 16	1 8	6	1875	1	20	22	125		Wooden hull, Rblt. 1903	
"Aberdeen"	79	3 18	3 9	0	1895	{ 1	16	24	120		Steel hull.	
							32	16	24	125		Steel hull.
"Robert Mackay"	80	9 17	6 10	0	1899		32	16	24	125		Steel hull.

" No. 1.....	90	0	26	0	6	0	Rebt. 1893	Horizontal non- condensing	1	15	20	100	{ Iron sheathed with elm. Formerly Floating Ele- vator, No. 1.
" "Sir Hugh Allan".....	130	0	26	0	15	0	1911	Vertical triple expansion condensing	1 1 1 1	16 25 40	24	180	Steel hull, twin screws.
" "Hon. John Young".....	91	8	22	0	9	0	1911	Vertical compound condensing	1 1	12 24	18	140	Steel hull, twin screws.
" "Passe-Partout".....	49	1	11	3	5	7	1912	Vertical high pressure	1 1	9	10	125	Wooden hull.
" "David Seath".....	75	0	19	0	10	2	1915	Vertical condensing	1	13 26	22	150	Wooden hull.
Testing boat.....	{ 73 73	3 3	14 14	0 0	3 3	1 1	1897						Two wooden scows braced 16 ft. apart.
Scows.													
2 Flat deck scows Nos. 2 & 4....	75	0	20	2	6	0	1876	Capacity. 67½ yds.					
1 " " No. 10.....	90	0	20	0	5	5	1891	80 "					
2 " " Nos. 21 & 22....	85	0	25	0	7	5	1891	150 "					
1 " " No. 23.....	85	0	25	0	6	9	1891	150 "					
4 " " Nos. 26-29....	85	0	25	0	6	9	1892	150 "					
5 " " Nos. 31-35....	85	0	25	0	6	9	1893	150 "					
2 " " Nos. 39 & 40....	85	0	25	0	6	9	1903	150 "					
2 " " Nos. 41 & 42....	87	0	25	0	7	6	1904	150 "					
13 " " Nos. 43-55....	100	0	30	0	9	0	1911-23	300 "					
2 Dump scows, Nos. 36 & 37....	106	0	26	10	9	6	1899	200 "					
1 " " No. 38.....	106	0	26	10	9	6	1900	200 "					
2 " " (Gilbert's)....	60	0	20	0	6	0	....	100 "					
1 large coal scow.....	138	0	32	0	8	5	....	400 tons					
1 floating concrete machine.....	100	0	34	0	8	6	{ 1915 Rebt.						
1 floating pile driver.....	50	9	24	2	5	8	1896						

AVERAGE DEPTH FOR EACH MONTH IN THE 30-FOOT CHANNEL AT SOREL
(30 Feet at Extreme Low Water of 1897)

Year	May	June	July	August	September	October	November	High	Low
1907.....	37' 1"	35' 9"	34' 3"	32' 10"	32' 4"	32' 9"	33' 7"	38' 3"	31' 10"
1908.....	41' 5"	37' 10"	33' 10"	32' 10"	32' 0"	31' 0"	30' 6"	42' 4"	30' 0"
1909.....	40' 6"	37' 6"	33' 10"	33' 2"	32' 7"	32' 4"	31' 6"	42' 7"	30' 11"
1910.....	35' 7"	34' 5"	32' 3"	31' 7"	31' 6"	31' 6"	31' 7"	37' 1"	30' 7"
1911.....	36' 6"	34' 6"	32' 1"	31' 3"	30' 9"	30' 2"	30' 3"	38' 1"	29' 4"
1912.....	37' 9"	37' 6"	33' 6"	32' 8"	32' 6"	32' 6"	34' 9"	40' 11"	31' 3"
1913.....	37' 0"	34' 4"	32' 8"	31' 10"	31' 6"	32' 1"	32' 7"	38' 6"	31' 1"
1914.....	35' 2"	33' 0"	32' 4"	31' 4"	31' 3"	30' 11"	31' 0"	36' 10"	30' 3"
1915.....	34' 7"	32' 6"	31' 6"	31' 4"	31' 1"	30' 11"	30' 8"	37' 4"	30' 1"
1916.....	38' 9"	37' 2"	34' 0"	32' 5"	31' 7"	31' 9"	31' 10"	40' 0"	30' 9"
1917.....	36' 8"	36' 6"	34' 10"	33' 6"	32' 3"	32' 6"	33' 0"	38' 2"	31' 3"
1918.....	35' 1"	33' 0"	32' 10"	30' 11"	31' 4"	32' 6"	33' 10"	36' 11"	30' 3"
1919.....	38' 7"	35' 7"	32' 5"	31' 4"	31' 1"	31' 7"	32' 9"	39' 11"	30' 3"
1920.....	33' 7"	30' 10"	30' 4"	29' 9"	29' 4"	29' 4"	29' 4"	34' 8"	28' 3"
1921.....	34' 7"	31' 9"	30' 10"	31' 7"	29' 10"	30' 2"	30' 5"	37' 6"	30' 1"
1922.....	36' 0"	33' 9"	34' 2"	32' 2"	31' 2"	31' 3"	30' 11"	37' 8"	30' 1"
1923.....	38' 4"	34' 6"	32' 4"	31' 5"	31' 4"	30' 11"	30' 9"	39' 1"	30' 0"

APPENDIX A.

BOUNDARY WATERS TREATY

In its report of May 3, 1906, the International Waterways Commission recommended that a treaty be negotiated between the United States and Great Britain, limiting the diversion of water at Niagara Falls. On June 29, 1906, the Burton Act was approved. Section 4 of this act requested the President to open negotiations with Great Britain for obtaining such a treaty. After some delay the treaty was prepared, and it was signed at Washington January 11, 1909. Having been duly ratified on May 5, 1910, it was proclaimed by the President on May 13 of the same year.

The text of the treaty is as follows:

Treaty Series, No. 548. Treaty Between the United States and Great Britain.—Boundary waters between the United States and Canada.

Signed at Washington January 11, 1909.

Ratification advised by the Senate March 3, 1909.

Ratified by the President April 1, 1910.

Ratified by Great Britain March 31, 1910.

Ratifications exchanged at Washington May 5, 1910.

Proclaimed May 13, 1910.

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA

A PROCLAMATION.

Whereas a treaty between the United States of America and His Majesty the King of the United Kingdom of Great Britain and Ireland and of the British dominions beyond the seas, Emperor of India, to prevent disputes regarding the use of boundary waters and to settle all questions which are now pending between the United States and the Dominion of Canada involving the rights, obligations, or interests of either in relation to the other, or to inhabitants of the other along their common frontier, and to make provision for the adjustment and settlement of all such questions as may hereafter arise, was concluded and signed by their respective plenipotentiaries at Washington on the eleventh day of January, one thousand nine hundred and nine, the original of which treaty is, word for word, as follows:

The United States of America and His Majesty the King of the United Kingdom of Great Britain and Ireland and of the British dominions beyond the seas, Emperor of India, being equally desirous to prevent disputes regarding the use of boundary waters and to settle all questions which are now pending between the United States and the Dominion of Canada involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other along their common frontier, and to make provision for the adjustment and settlement of all such questions as may hereafter arise, have resolved to conclude a treaty in furtherance of these ends, and for that purpose have appointed as their respective plenipotentiaries:

The President of the United States of America, Elihu Root, Secretary of State of the United States; and

His Britannic Majesty, the Right Honorable James Bryce, O.M., his ambassador extraordinary and plenipotentiary at Washington.

Who, after having communicated to one another their full powers, found in good and due form, have agreed upon the following articles:

PRELIMINARY ARTICLES

For the purposes of this treaty boundary waters are defined as the waters from main shore to main shore of the lakes and rivers and connecting waterways or the portions thereof, along which the international boundary between the United States and the Dominion of Canada passes, including all bays, arms, and inlets thereof, but not including tributary waters which in their natural channels would flow into such lakes, rivers, and waterways, or waters flowing from such lakes, rivers, and waterways, or the waters of rivers flowing across the boundary.

ARTICLE I.

The High Contracting Parties agree that the navigation of all navigable boundary waters shall forever continue free and open for the purposes of commerce to the inhabitants and to the ships, vessels, and boats of both countries equally, subject, however, to any laws and regulations of either country, within its own territory, not inconsistent with such privilege of free navigation and applying equally and without discrimination to the inhabitants, ships, vessels, and boats of both countries.

It is further agreed that so long as this treaty shall remain in force this same right of navigation shall extend to the waters of Lake Michigan and to all canals connecting boundary waters and now existing or which may hereafter be constructed on either side of the line. Either of the High Contracting Parties may adopt rules and regulations governing the use of such canals within its own territory and may charge tolls for the use thereof, but all such rules and regulations and all tolls charged shall apply alike to the subjects or citizens of the High Contracting Parties and the ships, vessels, and boats of both of the High Contracting Parties, and they shall be placed on terms of equality in the use thereof.

ARTICLE II.

Each of the High Contracting Parties reserves to itself or to the several State Governments on the one side and the Dominion or Provincial Governments on the other, as the case may be, subject to any treaty provisions now existing with respect thereto, the exclusive jurisdiction and control over the use and diversion, whether temporary or permanent, of all waters on its own side of the line which in their natural channels would flow across the boundary or into boundary waters; but it is agreed that any interference with or diversion from their natural channel of such waters on either side of the boundary, resulting in any injury on the other side of the boundary, shall give rise to the same rights and entitle the injured parties to the same legal remedies as if such injury took place in the country where such diversion or interference occurs; but this provision shall not apply to cases already existing or to cases expressly covered by special agreement between the Parties hereto.

It is understood, however, that neither of the High Contracting Parties intends by the foregoing provision to surrender any right which it may have to object to any interference with or diversion of waters on the other side of the boundary, the effect of which would be productive of material injury to the navigation interests on its own side of the boundary.

ARTICLE III.

It is agreed that, in addition to the uses, obstructions, and diversions heretofore permitted or hereafter provided for by special agreement

between the Parties hereto, no further or other uses or obstructions or diversions, whether temporary or permanent, of boundary waters on either side of the line, affecting the natural level or flow of boundary waters on the other side of the line, shall be made except by authority of the United States or the Dominion of Canada within their respective jurisdiction and with the approval, as hereinafter provided, of a joint commission, to be known as the International Joint Commission.

The foregoing provisions are not intended to limit or interfere with the existing rights of the Government of the United States on the one side and the Government of the Dominion of Canada on the other, to undertake and carry on governmental works in boundary waters for the deepening of channels, the construction of breakwaters, the improvement of harbors, and other governmental works for the benefit of commerce and navigation, provided that such works are wholly on its own side of the line and do not materially affect the level or flow of the boundary waters on the other, nor are such provisions intended to interfere with the ordinary use of such waters for domestic and sanitary purposes.

ARTICLE IV.

* * * * *

ARTICLE V.

The High Contracting Parties agree that it is expedient to limit the diversion of waters from the Niagara River so that the level of Lake Erie and the flow of the stream shall not be appreciably affected. It is the desire of both Parties to accomplish this object with the least possible injury to investments which have already been made in the construction of power plants on the United States side of the river under grants of authority from the State of New York, and on the Canadian side of the river under licenses authorized by the Dominion of Canada and the Province of Ontario.

So long as this treaty shall remain in force no diversion of the waters of the Niagara River above the Falls from the natural course and stream thereof shall be permitted except for the purposes and to the extent hereinafter provided.

The United States may authorize and permit the diversion within the State of New York of the waters of said river above the Falls of Niagara, for power purposes, not exceeding in the aggregate a daily diversion at the rate of twenty thousand cubic feet of water per second.

The United Kingdom, by the Dominion of Canada, or the Province of Ontario, may authorize and permit the diversion within the Province of Ontario of the waters of said river above the Falls of Niagara, for power purposes, not exceeding in the aggregate a daily diversion at the rate of thirty-six thousand cubic feet of water per second.

The prohibitions of this article shall not apply to the diversion of water for sanitary or domestic purposes, or for the service of canals for the purposes of navigation.

ARTICLE VI.

* * * * *

ARTICLE VII.

The High Contracting Parties agree to establish and maintain an International Joint Commission of the United States and Canada, composed of six commissioners, three on the part of the United States appointed by the President thereof, and three on the part of the United Kingdom appointed by His Majesty on the recommendation of the Governor in Council of the Dominion of Canada.

ARTICLE VIII.

This International Joint Commission shall have jurisdiction over and shall pass upon all cases involving the use or obstruction or diversion of the waters with respect to which, under Articles III and IV of this treaty, the approval of this commission is required, and in passing upon such cases the commission shall be governed by the following rules or principles which are adopted by the High Contracting Parties for this purpose:

The High Contracting Parties shall have, each on its own side of the boundary, equal and similar rights in the use of the waters hereinbefore defined as boundary waters.

The following order of precedence shall be observed among the various uses enumerated hereinafter for these waters, and no use shall be permitted which tends materially to conflict with or restrain any other use which is given preference over it in this order of precedence:

First. Uses for domestic and sanitary purposes.

Second. Uses for navigation, including the service of canals for the purposes of navigation.

Third. Uses for power and for irrigation purposes.

The foregoing provisions shall not apply to or disturb any existing uses of boundary waters on either side of the boundary.

The requirement for an equal division may, in the discretion of the commission, be suspended in cases of temporary diversions along boundary waters at points where such equal division can not be made advantageously on account of local conditions and where such diversion does not diminish elsewhere the amount available for use on the other side.

The commission in its discretion may make its approval in any case conditional upon the construction of remedial or protective works to compensate so far as possible for the particular use or diversion proposed, and in such cases may require that suitable and adequate provision, approved by the commission, be made for the protection and indemnity against injury of any interests on either side of the boundary.

In cases involving the elevation of the natural level of waters on either side of the line as a result of the construction or maintenance on the other side of remedial or protective works or dams or other obstructions in boundary waters or in waters flowing therefrom or in waters below the boundary in rivers flowing across the boundary, the commission shall require, as a condition of its approval thereof, that suitable and adequate provision, approved by it, be made for the protection and indemnity of all interests on the other side of the line which may be injured thereby.

The majority of the commissioners shall have power to render a decision. In case the commission is evenly divided upon any question or matter presented to it for decision, separate reports shall be made by the commissioners on each side to their own Government. The High Contracting Parties shall thereupon endeavor to agree upon an adjustment of the question or matter of difference, and if an agreement is reached between them it shall be reduced to writing in the form of a protocol, and shall be communicated to the commissioners, who shall take such further proceedings as may be necessary to carry out such agreement.

V

ARTICLE IX.

The High Contracting Parties further agree that any other questions or matters of difference arising between them involving the rights, obligations or interests of either in relation to the other or to the inhabitants of the other, along the common frontier between the United States and the Dominion of Canada, shall be referred from time to time to the International Joint Commission for examination and report, whenever either the Government of the United States or the Government of the Dominion of Canada shall request that such questions or matters of difference be so referred.

The International Joint Commission is authorized in each case so referred to examine into and report upon the facts and circumstances of the particular questions and matters referred, together with such conclusions and recommendations as may be appropriate, subject, however, to any restrictions or exceptions which may be imposed with respect thereto by the terms of the reference.

Such reports of the commissions shall not be regarded as decisions of the questions or matters so submitted either on the facts or the law, and shall in no way have the character of an arbitral award.

The commission shall make a joint report to both Governments in all cases in which all or a majority of the commissioners agree, and in case of disagreement the minority may make a joint report to both Governments or separate reports to their respective Governments.

In case the commission is evenly divided upon any question or matter referred to it for report, separate reports shall be made by the commissioners on each side to their own Government.

ARTICLE X.

* * * * *

ARTICLE XI.

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ARTICLE XII.

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ARTICLE XIII.

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ARTICLE XIV.

The present treaty shall be ratified by the President of the United States of America, by and with the advice and consent of the Senate thereof, and by His Britannic Majesty. The ratifications shall be exchanged at Washington as soon as possible and the treaty shall take effect on the date of the exchange of its ratifications. It shall remain in force for five years, dating from the day of exchange of ratifications, and thereafter until terminated by twelve months' written notice given by either High Contracting Party to the other.

In faith whereof the respective plenipotentiaries have signed this treaty in duplicate and have hereunto affixed their seals.

Done at Washington the eleventh day of January, in the year of our Lord nineteen hundred and nine.

(Signed) ELIHU ROOT. [SEAL.]

(Signed) JAMES BRYCE [SEAL.]

And whereas the Senate of the United States by their resolution of March third, nineteen hundred and nine (two-thirds of the Senators present concurring therein), did advise and consent to the ratification of the said treaty with the following understanding, to wit:

Resolved further (as a part of this ratification), That the United States approves this treaty with the understanding that nothing in this treaty shall be construed as affecting or changing any existing territorial or riparian rights in the water, or rights of the owners of lands under water, on either side of the international boundary at the rapids of the Saint Marys River at Sault Sainte Marie, in the use of the waters flowing over such lands, subject to the requirements of navigation in boundary waters, and of navigation canals, and without prejudice to the existing right of the United States and Canada, each to use the waters of the Saint Marys River within its own territory; and further, that nothing in this treaty shall be construed to interfere with the drainage of wet, swamp, and overflowed lands into streams flowing into boundary waters, and that this interpretation will be mentioned in the ratification of this treaty as conveying the true meaning of the treaty, and will, in effect, form part of the treaty.

And whereas the said understanding has been accepted by the Government of Great Britain, and the ratifications of the two Governments of the said treaty were exchanged in the city of Washington on the fifth day of May, one thousand nine hundred and ten;

Now, therefore, be it known that I, William Howard Taft, President of the United States of America, have caused the said treaty and the said understanding, as forming a part thereof, to be made public, to the end that the same and every article and clause thereof may be observed and fulfilled with good faith by the United States and the citizens thereof.

In testimony whereof I have hereunto set my hand and caused the seal of the United States to be affixed.

Done at the city of Washington this thirteenth day of May, in the year of our Lord nineteen hundred and ten, and of the independence of the United States of America the one hundred and thirty-fourth.

[SEAL.]

WM. H. TAFT.

By the President:

P. C. KNOX,

Secretary of State.

